Rainbow™ 100

Owner's Manual

digital

EK-P100E-OM-002

Rainbow™ 100

Owner's Manual

digital equipment corporation

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This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- reorient the receiving antenna
- move the computer away from the receiver
- plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful:

How to Identify and Resolve Radio–TV Interference Problems

This booklet is available from the US Government Printing Office, Washington, DC 20402, Stock No. 004-000-00345-4.

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Preface

This manual briefly describes the hardware components of your Rainbow™ 100 computer, and presents the Set-Up features that allow you to adapt the computer to your needs. Special emphasis is given to two important procedures that expand the computer's capabilities: adding a printer and connecting a communications line.

The manual also describes how to test your computer by using its internal diagnostic test and its diskette diagnostic tests. With these tests you can isolate problems that may occur in the computer's components.

Before reading this manual, use the *Rainbow™ 100 Installation Guide* to help you install the computer.

The manual is divided into the following chapters and appendices, each pertaining to a specific subject area concerning your Rainbow 100 computer.

- **Chapter 1, Your Rainbow 100 Computer**, describes the basic components of the Rainbow 100 computer.

- **Chapter 2, Set-Up,** describes the features in your Rainbow 100 computer that enable you to match its communications signals to those of your printer and communications line.
- **Chapter 3, Connecting a Printer to Your Rainbow 100 Computer,** describes the connections, Set-Up selections, and signals used in the procedure.
- **Chapter 4, Communications,** describes how to connect a telephone line to your Rainbow 100 computer by use of a modem, and the signals involved.
- **Chapter 5, System Tests,** discusses the internal diagnostic tests and the diskette diagnostic tests that verify that the system is working correctly or detect system problems.
- **Chapter 6, Troubleshooting,** lists symptoms of problems that may occur, their possible causes, and the actions you can take to correct them.
- **Appendix A, Rainbow 100 Computer Specifications,** summarizes the Rainbow 100 computer's hardware specifications.
- **Appendix B, Rainbow 100 Error Messages,** lists the error messages that may appear during system and disk drive diagnostic testing and the actions you can take to correct their causes.
- **Appendix C, Rainbow 100 Parts List and Reference Manuals,** lists user-replaceable parts of the Rainbow 100 computer and other manuals that refer to the Rainbow 100 computer.
- **Appendix D, International Language Keyboards,** illustrates the different national language keyboards available.

At the end of the manual you will find a **Glossary** of important terms and an **Index.**

The keys on the Rainbow 100 keyboard that are mentioned in text appear in boldface (for example, "press the **Shift** key," or "press <**Shift**>"). Note that <**Return**> represents the **Return** key, and to press <**Shift/A**> means to hold down the **Shift** key and press the **A** key at the same time. User responses are in color when they appear in computer dialog.

1

Your Rainbow 100 Computer

The Rainbow 100 Computer

The Rainbow 100 computer, shown in Figure 1-1, consists of a VR201 monitor, an LK201 keyboard, and a system unit. The system unit contains an RX50 dual-disk drive, a power supply, a switch and fan assembly, and the system module.

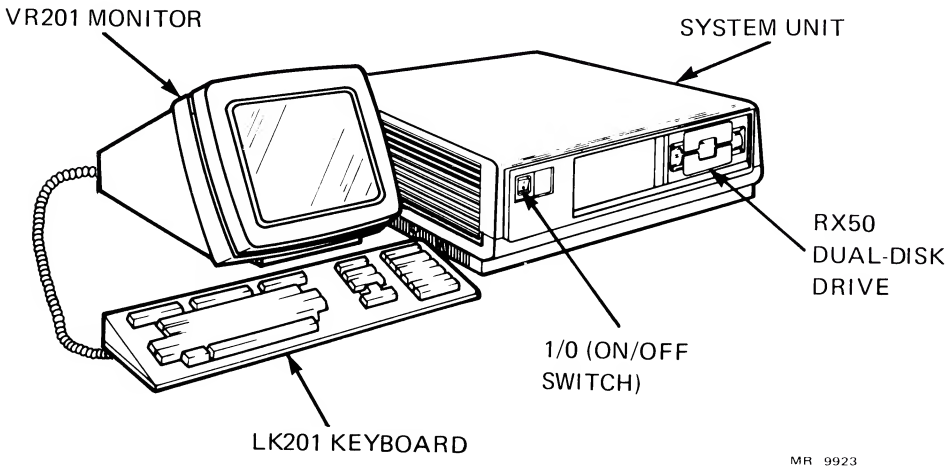


Figure 1-1. Rainbow 100 Computer

The Rainbow 100 system module has a dual-processor design that uses a Z80A® 8-bit processor coupled with an 8088 16-bit processor. The Rainbow 100 computer's system functions are divided between the two processors, as shown in the block diagram, Figure 1-2. The Z80A processor controls the dual-disk drive's reading and writing of data, while the 8088 processor controls the monitor, the keyboard, the communications connector, and all options added to the system.

The Rainbow 100 computer comes with 64K (65,536) bytes of main memory. (A byte represents one character position.) This memory can be expanded to 256K bytes with the addition of a memory extension option. The computer also comes with a dual-disk drive that holds 800K bytes of auxiliary memory on two 5¼ inch diskettes. You can add a second dual-disk drive to the system to bring the total auxiliary memory to 1.6 million bytes.

The Rainbow 100 computer's communications connector can be connected to a telephone modem or connected directly to another computer. (A modem is used to communicate with another computer over a telephone line.) Chapter 4 gives you information on communications connections.

The Rainbow 100 computer also has a printer connector you can use to connect one of the following printers available from Digital Equipment Corporation for its personal computers.

- LA50 Personal Printer
- LA100 Letterprinter 100
- LQP02 Letter-Quality Printer

You may also use any other serial printer with the same FCC classification (Class B).

Human Engineering in Design of Components

The Rainbow 100 computer's design makes it easy to install, comfortable to operate, and easy to repair. Human engineering considers the total relationship between you and the computer. Digital has made the system comfortable to

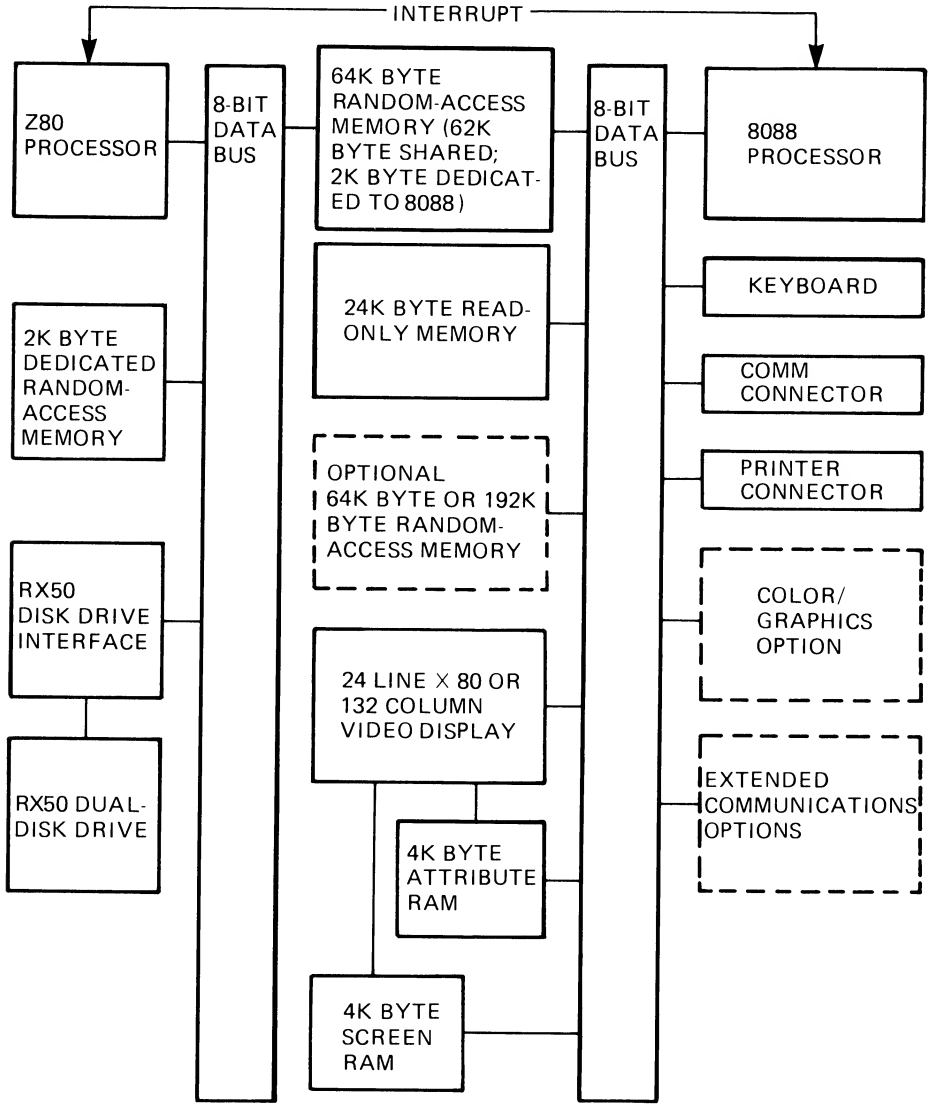


Figure 1-2. Rainbow 100 Computer, Block Diagram

MR 9924

operate by minimizing conditions that might lead to strain and fatigue. Digital has also made the system flexible so that you have the freedom to adapt it to your needs.

The 3-component structure of the Rainbow 100 computer allows you to place the components in many locations. You can use the optional floor stand to hold the system unit and keep your work surfaces free. The components are light, compact, and portable. The keyboard comes with a 1.8 m (6 ft) cord that lets you place it anywhere comfortable, even on your lap.

See Appendix A for a summary of the Rainbow 100 computer's specifications.

The Monitor

The Rainbow 100 computer's monitor contains a video screen whose diagonal dimension is 30.5 cm (12 inches). The screen is coated to reduce glare. (Do not touch the screen; fingerprints show up very easily. When necessary, clean the screen with the recommended cleaner and a lint free cloth.)

The monitor supplies you video information, but also provides the internal connection for the keyboard. (The video control system resides on the system module inside the system unit.) The monitor has the following features.

- 24-line × 80- or 132-column display
- Jump or smooth scrolling
- Double-height characters (by line)
- Double-width characters (by line)
- Normal and reverse video (by character)
- Boldface, blinking, and underlined characters (by character)
- Dark or light screen background
- Auto-screen blanking

Also, two controls on the monitor's rear panel let you adjust the screen's brightness and contrast levels as you would on a television set.

The Keyboard

The Rainbow 100 computer uses a low-profile keyboard that has 105 keys, as shown in Figure 1-3. The standard keys at the center and left provide the uppercase and lowercase alphabets, numbers, and punctuation. To the right of these keys are the basic editor keys (**Insert/Here**, **Remove**, **Find**, **Select**, **Prev Screen**, and **Next Screen**) and the cursor control keys (↑, ↓, ←, →). On the far right is the numeric keypad.

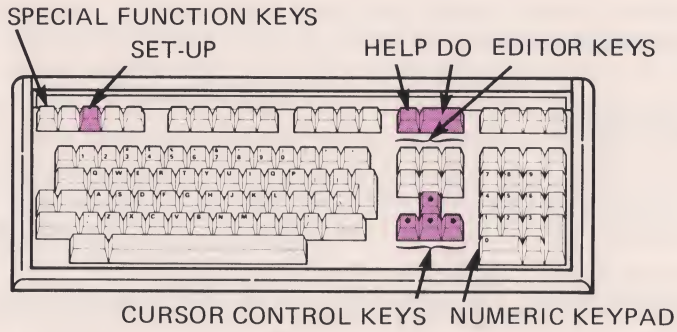


Figure 1-3. Keyboard

Across the top of the keyboard are the special function keys. Included in these keys are the **Set-Up** key, the **Help** key (which calls a help message to the screen in Set-Up mode only), and the **Do** key. (The **Do** key separates the "execute" function from the "carriage return" function within an application program that can distinguish these functions.) Also included in the top row are the special function keys for different types of applications – word processing, electronic mail, accounting spreadsheets, etc. These keys can be custom labeled with a removable strip for each application.

Keyboard Features

The keyboard has the following features.

- A low profile that allows access to the dual-disk drive in the system unit, should you want to place the two components on the same table or desk.
- Keyclick sounds as the keys are pressed. You can adjust the keyclick volume or turn it off.

- A keyboard tone generator that produces a margin bell. The bell volume is also adjustable.
- Auto-repeat of all keys on the main keypad array, the numeric keypad, and the function keys (including **Space**, **Del Char**, and **Tab**).

The keys are arranged in an electrical matrix, which is scanned for keys that are pressed. A single-chip, 8-bit processor detects whenever a key is pressed and transmits the event to the system module.

Keyclicks will not sound when the keyboard is turned off by the system. (The Wait light is on when this is so.)

Keyboard Lights

The keyboard has four lights that can be turned on and off by the system. These lights are assigned specific functions during normal system operation, but are also used to signal error conditions should the power-up selftest fail (in which case all four lights flash). The lights have the following meanings when on.

Light	Meaning
Hold Screen	The **Hold Screen** key has been pressed. New data will not be added to the monitor's screen until you press **Hold Screen** again.
Lock	The **Lock** key has been pressed, enabling caps lock mode.
Compose	The **Compose** key has been pressed (for special applications only). (CP/M-86/80 does not support this key.)
Wait	Keyboard transmission has been temporarily stopped by the system.

The System Unit

The system unit, shown in Figure 1-4, contains the power supply, the system module, a dual-disk drive, a fan, and the system power switch. This unit can be placed horizontally on a desk or vertically in the optional floor stand.

Placing the system unit in the floor stand decreases the amount of desk space needed by the personal computer. The floor stand also keeps the unit fixed and allows it enough airflow.

The components of the system unit are designed to make installation of options and maintenance of components easy. The system unit's cover is secured by sliding latches under its left and right sides. The disk drives and power supply can be removed by disconnecting their cables and releasing their latches. The system module slides out the back of the system unit. This module has connectors on it for mounting the disk controller, a memory extension option, and other options as they become available.

The connectors for power and peripheral devices are at the back of the system unit, as shown in Figure 1-5. They are unique in design to prevent misconnections and are labeled in English: COMM (for an optional communications line), PRINTER, and VIDEO (for the monitor cable).

Seven lights at the back of the system unit indicate the source of any problem with the computer. These lights provide a backup to error messages and are especially useful should the monitor fail.

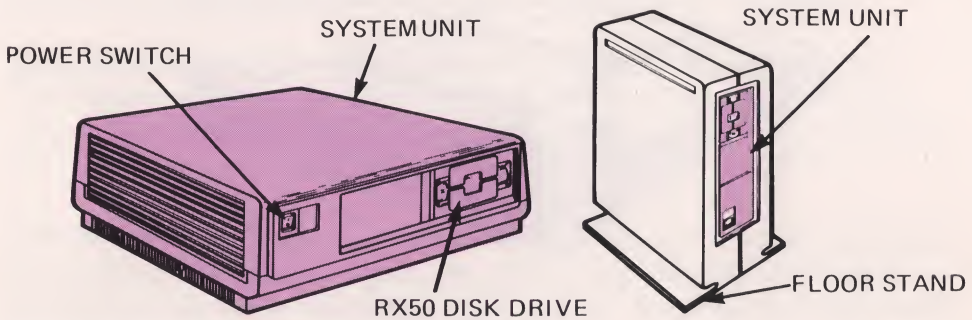


Figure 1-4. System Unit, Front View

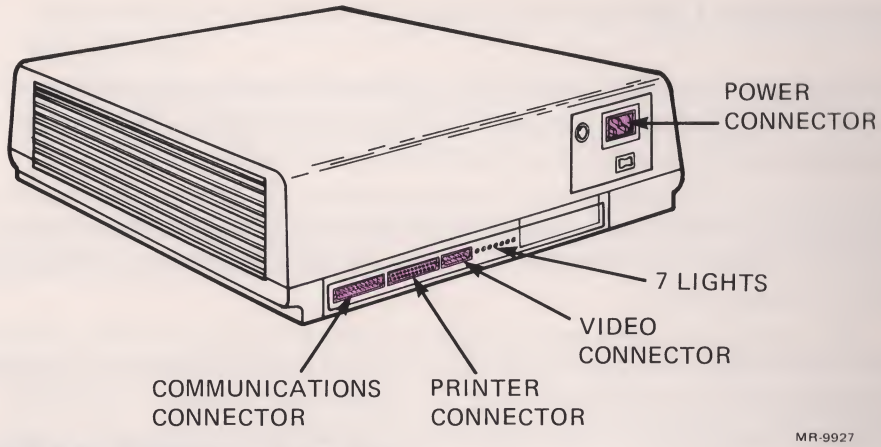


Figure 1-5. System Unit, Back View

The System Module

The system module, located inside the system unit, is made up of electrical components and circuits. Its major components are the two processors (Z80A and 8088), memory chips, and communications hardware. Mounted on the system module is the RX50 controller module, as shown in Figure 1-6. It controls reading and writing on the disk drives. The system module has other connectors for mounting a memory extension option and other options as they become available.

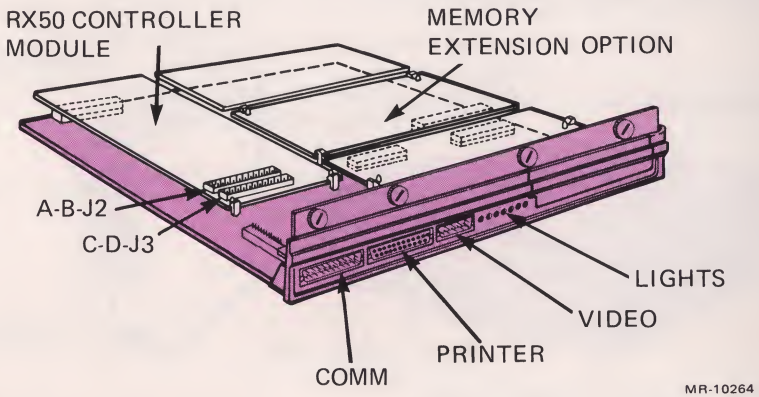


Figure 1-6. System Module

You can expand the system module's memory by adding a 64K byte or a 192K byte memory extension option. The system module also has a 24K byte ROM, which contains diagnostic tests, a bootstrap program, and the terminal mode program. (See Figure 1-2.)

The Z80A processor has sole access to the RX50 controller module. Available to the processor are 64K bytes of RAM, which is divided into 62K bytes of shared memory and 2K bytes of unshared memory. The 62K bytes are shared with the 8088 processor.

The 8088 processor controls the monitor, the keyboard, the printer, and the communications line. It also controls any additional options that may be added to the system module.

The 8088 processor also has a screen and attribute memory, which allows it to control the information on the monitor.

The RX50 Dual-Disk Drive

The Rainbow 100 computer uses a compact disk subsystem that consists of a disk controller module and a dual-disk drive, which controls two 5¼ inch diskettes on a single spindle. The diskettes provide mass storage, data exchange, and file backup capabilities. Each diskette stores 400K bytes of information.

The dual-disk drive has two spindles that are turned by the same drive motor. The drive accesses its two diskettes by a single-head carriage assembly, which is moved by one stepper motor/lead screw combination.

Each disk drive has two sensors that detect when a diskette is installed in it. These sensors also look for the notch on the side of the diskette's protective cover to see if the diskette is write protected. If this notch is covered, the disk drive cannot write on the diskette.

IMPORTANT: *The dual-disk drive comes with a protective card installed to keep the drive's carriage stable during shipment. Save the card and reinstall it every time you move the system unit or pack it for shipment. Install the protective card in the following way.*

1. *Open the door of drive A (and drive C, if present).*
2. *Remove any diskette(s) from the drive(s).*
3. *Turn on the power and wait for a bell tone from the keyboard.*
4. *Turn off the power.*
5. *Insert the protective card into drive A (and drive C, if present) as shown in Figure 1-7.*
6. *Close the door of the drive(s).*

Refer to Appendix A for a summary of the dual-disk drive's specifications.

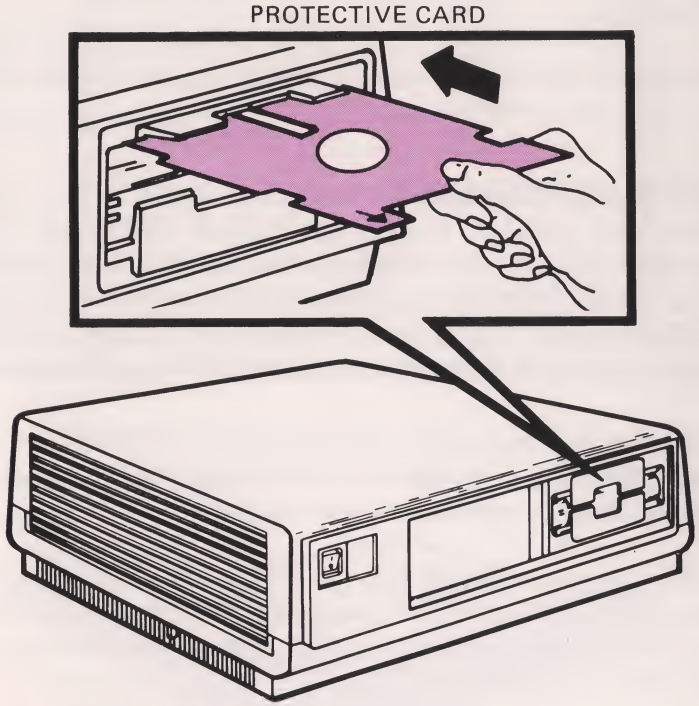


Figure 1-7. Protective Card MR-9928

2
Set-Up

Introduction

Pressing the **Set-Up** key, shown in Figure 2-1, causes the system to enter Set-Up and place the Set-Up display on the monitor, as shown in Figure 2-2. When the system enters Set-Up, the text on your screen will be temporarily replaced by the Set-Up display. This will not cause any of your text to be erased *unless* you perform one of the following procedures while in Set-Up.

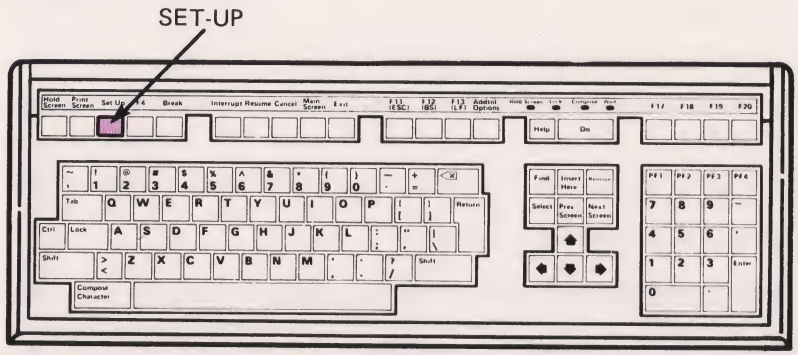


Figure 2-1. Set-Up Key Location

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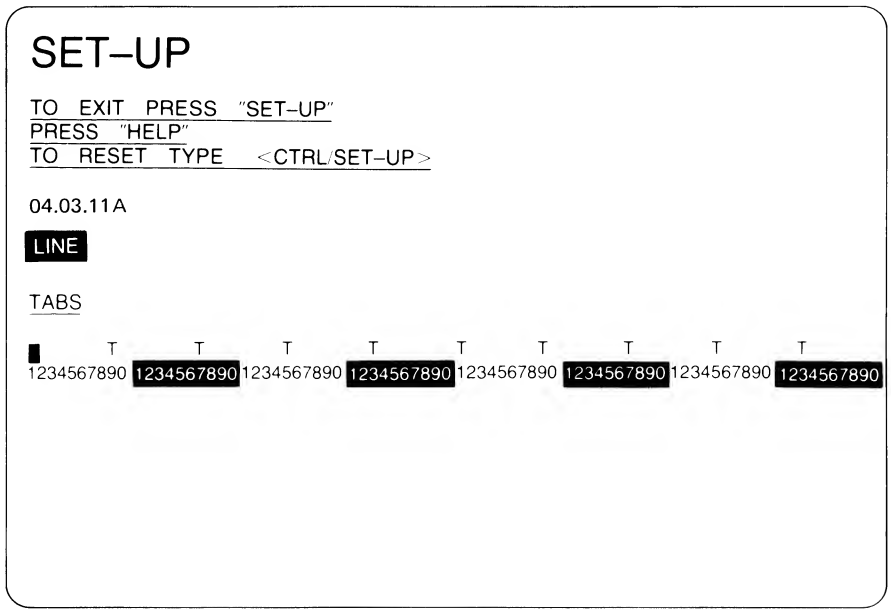


Figure 2-2. Set-Up Display – Tabs

- Change screen width
- Use default Set-Up values
- Recall Set-Up values

Set-Up allows you to change the following Rainbow 100 computer features.

- Tab stops
- Settings to match those of your printer
- Settings to match those of any communications device attached to the computer
- Number of characters displayed across the monitor (screen width)
- Cursor style to block or underline
- Screen background to dark or light

Set-Up also allows you to do the following.

- Select automatic repeating of keyboard keys
- Enable the margin bell and change its volume
- Enable the keyclick feature and change its volume
- Enter a 20-character message for identification on a communications line

These features are divided into areas of common usability called major headings. Each major heading has a specific display associated with it that appears on the monitor. There are six major headings in the Rainbow 100 computer, each having a number of selections that can be changed. These selections are also called minor headings. The major headings and the number of selections in each are as follows.

Major Heading	Number of Selections (Minor Headings)
Tabs	2
Param(eter) Set(tings)	24
Modem	5
Printer	2
Misc(ellaneous)	3
Memory	1

Once you press the **Set-Up** key, you can move from one major heading to another by using the **Next Screen** or **Prev Screen** key. Once you select a major heading, you can step through its minor headings, parameters, or tab settings by using the → or ← key.

The minor heading selected is displayed in reverse video; a tab setting is displayed by a cursor position. You can step through the values of each selection by using the ↑ or ↓ key.

Help

While in Set-Up, pressing the **Help** key causes a help message to appear on the monitor. This help message is a quick reminder on how to change the settings in Set-Up. Pressing the **Help** key again returns you to your current major heading. You cannot make any changes until you exit Help.

Tabs Major Heading

When you enter Set-Up, you are immediately in the Tabs major heading, as shown in Figure 2-2. In this heading you can change the tab stop settings and switch the computer between line and local operations. You can move to the next major heading by pressing the **Next Screen** key and return to the Tabs major heading by pressing the **Prev Screen** key.

NOTE: The number 04.03.11A, shown in Figure 2-2, is the version of the computer's firmware, which in your computer may be different.

Tab Stops

When entering Set-Up, the numbers across the middle of the monitor represent the columns on the monitor in which you can place characters. There are either 80 or 132 possible character positions, depending on the screen-width setting. The Ts indicate the current tab stop settings. For information on setting tab stops, refer to the *Rainbow™ 100 User's Guide.*

Local and Line Modes

The Rainbow 100 computer must be set to LINE in order for it to communicate with any external device (a printer or a telephone line). When you place the computer in Set-Up, either LINE or LOCAL is displayed on the monitor to indicate the computer's current mode. It will stay in this mode unless you change it or reset the system. If you place the computer in local mode and exit Set-Up, the keys you press on the keyboard will echo their characters on the monitor. (Normally, you would leave this feature on LINE.) While in Set-Up you can change this feature by typing **L**.

If you want to return to your Main System Menu at this time, press the **Set-Up** key. If not, press <**Next Screen**> to select the Parameter Settings major heading.

Parameter Settings Major Heading

The Parameter Settings major heading is shown in Figure 2-3. The current selections (0s or 1s) of all the settings in this major heading are printed on a line across the middle of the monitor. Each selection's name is also printed on the monitor. Below the name is the meaning of each value you select. Figure 2-4 summarizes the selections possible and shows their default values. Table 2-1 lists the selections in the order in which they are displayed on the monitor.

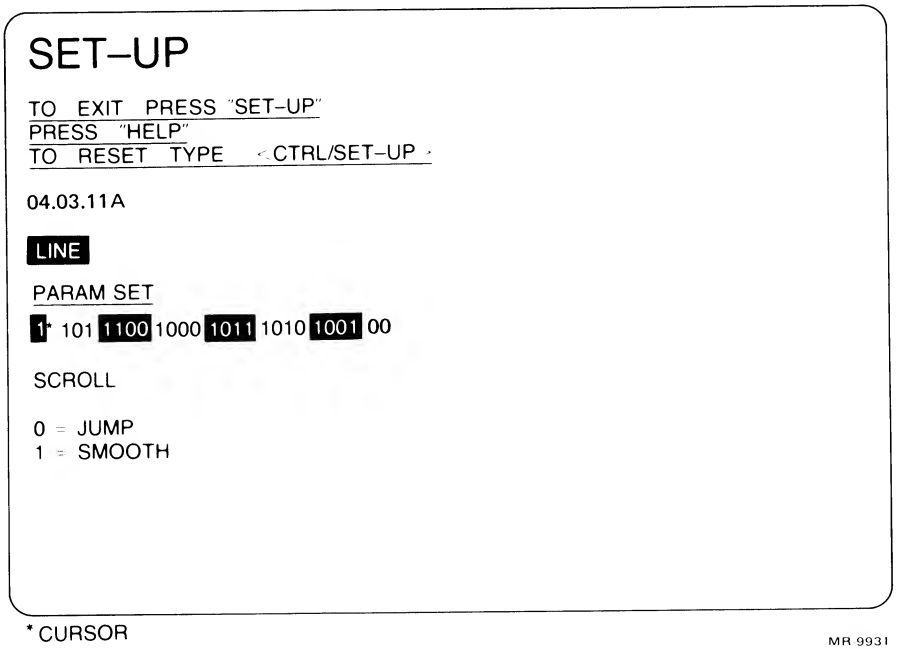


Figure 2-3. Set-Up Display – Param(eter) Set(tings)

Certain selections have meaning only when the Rainbow 100 computer is being used as a terminal (in terminal mode). These selections are identified by an asterisk in Table 2-1.

To change the value of the current selection, press the ↑ or ↓ key. To proceed to the next selection, press the → key. To return to a previous selection, press the ← key. To return to the first selection shown in Figure 2-4, press the **Return** key.

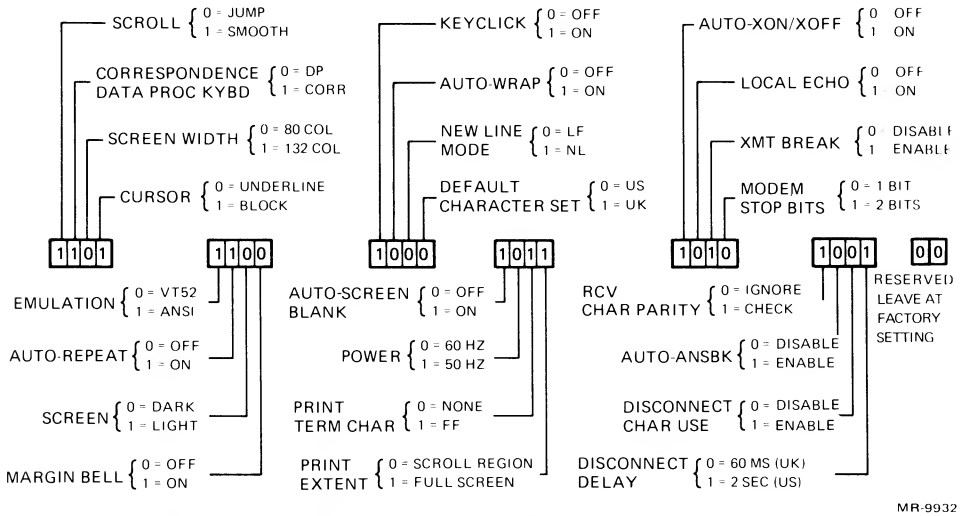


Figure 2-4. Summary of Parameter Settings

The CP/M-86/80 operating system needs certain selections set to specific values. Table 2-2 lists these selections.

The following paragraphs describe the selections you should check when you add a communications line or a printer to your Rainbow 100 computer. The selections meant primarily for the operator are described in the *Rainbow™ 100 User's Guide.*

Scroll

This parameter applies to the upward and downward movement of lines of text on the monitor to make room for new lines. With jump scroll, the characters on the monitor advance upward a full line of characters at a time, and new lines of characters are added at the bottom of the monitor. If auto-XON/XOFF is off, use jump scroll.

With smooth scroll, the characters on the monitor advance one-tenth of a line (one scan line) at a time. Smooth scrolling increases your ability to read new data as you receive it. You can set a limit on the smooth scroll rate in the Misc major heading. A scroll rate setting of 1, 2, or 3 represents 3, 6, or 12 lines per second, respectively. If auto-XON/XOFF is on, you may wish to use smooth scroll.

Table 2-1. Parameter Settings Major Heading

Selection (Minor Heading)	Values†
Scroll	0 = Jump **1** = Smooth
Correspondence/ Data Processing keyboard	0 = DP (data processing) **1** = Corr. (correspondence)
Screen width	**0** = 80 (columns) 1 = 132 (columns)
Cursor	0 = Underline **1** = Block
Emulation	0 = VT52 **1** = ANSI
Auto-repeat	0 = Off **1** = On
Screen	**0** = Dark 1 = Light
Margin bell	**0** = Off 1 = On
Keyclick	0 = Off **1** = On
Auto-wrap	**0** = Off 1 = On
New line mode	**0** = LF (line feed) 1 = NL (new line)
Default character set	**0** = U.S. ASCII (#) 1 = U.K. (£)
Auto-screen blank	0 = Off **1** = On
Power	**0** = 60 Hz 1 = 50 Hz
Print termination character*	0 = None **1** = FF (form feed)

*This selection has meaning only in terminal mode.
†Values in boldface are the default settings.

Table 2-1. Parameter Settings Major Heading (Cont)

Selection (Minor Heading)	Values†
Print extent*	0 = Scroll region **1** = Full screen
Auto-XON/XOFF*	0 = Off **1** = On
Local echo*	**0** = Off 1 = On
Transmit break*	0 = Disable **1** = Enable
Modem stop bits	**0** = 1 (bit) 1 = 2 (bits)
Received character parity*	0 = Ignore **1** = Check
Auto-answerback*	**0** = Disable 1 = Enable
Disconnect character use*	**0** = Disable 1 = Enable
Disconnect delay*	0 = 60 ms **1** = 2 s

*This selection has meaning only in terminal mode.
†Values in boldface are the default settings.

Table 2-2. Parameters Set for CP/M-86/80 Compatibility

Parameter	Selection	Value
Emulation (ANSI/VT52)	ANSI	1
Auto-wrap	Off	0
New line mode	LF (Line feed)	0

Correspondence/Data Processing Keyboard

Most keys on the keyboard have either one or two characters labeled on them. When you press the **Shift** key, the upper character is displayed on the screen. Some keys on keyboards used in countries other than the United States and Australia have keys with three or four characters labeled on them. On these keyboards, you can choose which characters you want to display on the screen as follows.

Set-Up Selection	Keyboard Characters Used
Correspondence	Characters labeled on the left side of the key cap.
Data Processing	Characters labeled on the right side of the key cap.

If you print a file containing a British pound sign (£), the number sign (#) is printed instead.

Screen Width

This parameter allows you to select the monitor's screen width, either 80 or 132 columns. The number of characters that can be displayed in each screen width are as follows.

Screen Width	Single-Width Characters	Double-Width Characters
80	80	40
132	132	66

CAUTION: *Changing the screen width will erase the data you had displayed on the monitor before you entered Set-Up.*

Emulation

The emulation selection allows you to choose the style of character strings for special control functions. With VT52 selected, the Rainbow 100 computer transmits and responds to character strings like a VT52 DECscope. With ANSI selected, the Rainbow 100 computer transmits and responds to character strings according to the format established by the American National Standards Institute (ANSI).

Auto-Wrap

With auto-wrap enabled, any displayable character received when the cursor is at the right margin is automatically placed at the beginning of the next line, scrolling up if needed. With auto-wrap disabled, any character trying to print past the right margin writes over the last character position on that line. The auto-wrap feature should be off for the CP/M-86/80 operating system. In terminal mode, this feature should be set to match the remote computer.

New Line Mode

In line feed (LF) mode, a received line feed will perform a cursor index to the same character position on the next line. Pressing <**Return**> sends the carriage return code only.

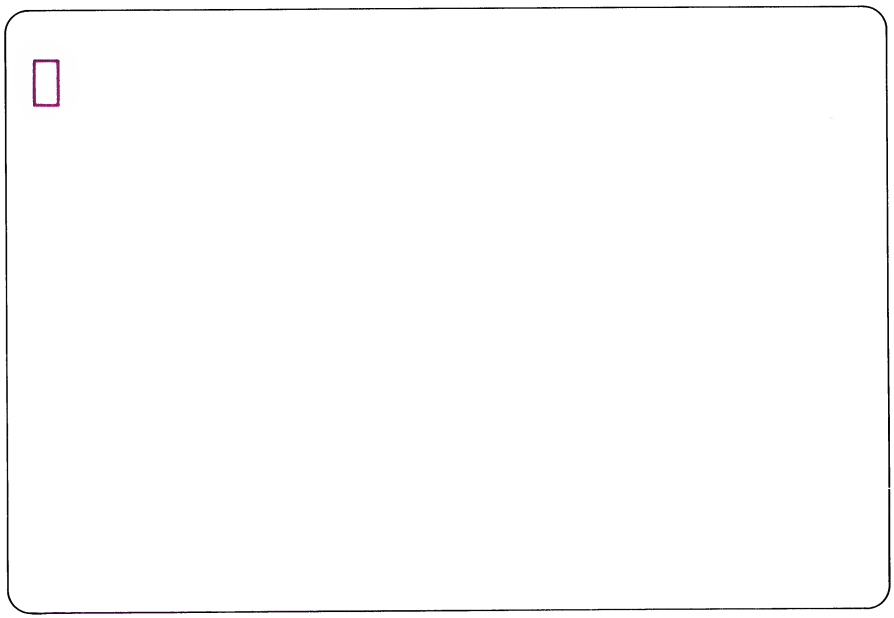
In new line (NL) mode, a received line feed will cause the cursor to move to the beginning of the next line. Pressing <**Return**> causes the transmission of both a carriage return and a line feed code. New line mode should be off for the CP/M-86/80 operating system.

Default Character Set

When you set this parameter to 0, the computer transmits codes that agree with the American Standard Code for Information Interchange (ASCII). These codes are standard for printers and communications devices so they can transfer information using a common data pattern. When you set this parameter to 1, the code for the # symbol on reception only is switched to that of the British pound sign (£).

Auto-Screen Blank

With this feature on (the default condition), the output to the monitor will be turned off after about 30 minutes of not receiving characters. A blinking "phantom" cursor will appear on the monitor, as shown in Figure 2-5, to indicate that the system is still on. To bring back the data you had on the monitor, press the **Shift** key and the display on the monitor will be restored. The **Shift** key has no meaning to a program (important here since the program may have been waiting for a response from you before the screen went blank).



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Figure 2-5. Auto-Screen Blank "Phantom" Cursor

Power

This feature sets the monitor's screen refresh rate to match the power line frequency. In the U.S., 60 Hz is common; 50 Hz is common in other countries. If you have a problem with a rolling screen, horizontal lines, or a screen background that flickers, use the 0 setting.

Print Termination Character

This setting applies only to terminal mode. It determines if a form feed (FF) character is to be sent automatically to the printer at the end of every print screen function.

Print Extent

This selection applies only to terminal mode. It determines the characters that will be printed during a print screen operation. When you set the feature to full screen, all characters on the screen print. When you set the feature to scroll region, only the characters in the scroll region print. The scroll region is the

screen area between the top and bottom margins. Normally, the remote computer selects the margins; if it does not, all characters on the screen print.

Auto-XON/XOFF

This selection applies only to terminal mode. When auto-XON/XOFF is on, the Rainbow 100 computer will automatically be synchronized to a remote computer that uses XON and XOFF control signals. When the Rainbow 100 computer receives more characters than it can handle, it automatically sends an XOFF control character to the remote computer, which tells it to stop sending data. When the Rainbow 100 computer can accept more data, it sends an XON control character to tell the remote computer to resume data transmission. Also, on reception of an XOFF signal, the Rainbow 100 computer stops sending data to the remote computer. On receipt of an XON signal, the Rainbow 100 computer resumes sending data.

Local Echo

This feature applies only to terminal mode. When on (except in Set-Up), all keys typed are echoed (displayed) on the monitor and are transmitted to the remote computer. Enable this feature if the remote computer is not echoing the characters you type. When this feature is off, all keys typed are transmitted to the remote computer without their being echoed on the monitor.

When not in terminal mode, the operating system of the Rainbow 100 computer echoes on the monitor the characters you type.

Transmit Break

When this selection is enabled, pressing the **Break** key places a space signal on the transmit data line. If the terminal is not transmitting, no signal will be sent. Also, no space signal will be sent if this selection is disabled.

NOTE: *Disabling the transmit break function does not affect a <Shift/Break>, which causes the modem line to disconnect, or a <Ctrl/Break>, which sends the answerback message on the transmit data line.*

Modem Stop Bits

The modem stop bits selection places 1 or 2 stop bits at the end of each character's data pattern. Normally, 1 stop bit is used with baud rates higher than 110, and 2 stop bits are used with baud rates of 110 and lower.

Received Character Parity

This selection applies only to terminal mode. When set to "check," this selection allows the computer to check for errors in the data patterns of received characters. For example, suppose the remote computer has sent an even number of data pulses for even parity. If the Rainbow 100 computer does not receive an even number of pulses, it does not display the character; instead, it displays the substitution character .

When this selection is set to "ignore," the Rainbow 100 computer does not check for parity errors in received characters.

Auto-Answerback

The auto-answerback feature applies only to terminal mode. When it is enabled, the Rainbow 100 computer automatically transmits its answerback message when a telephone connection is made. (See "Answerback Message" below.) When this feature is disabled, no message is sent.

Disconnect Character Use

The disconnect character use selection applies only to terminal mode. When it is enabled and the Rainbow 100 computer receives a disconnect character, it will disconnect the telephone line. (See Chapter 4 for additional information.) Pressing <**Shift/Break**> sends a disconnect character on the transmit data line.

Disconnect Delay

The disconnect delay selection applies only to terminal mode. It allows either a 60 ms delay (typical in the United Kingdom) or a 2 second delay (typical in the United States and other countries) before disconnecting the telephone line.

NOTE: *Disconnect delay is active only for FDXB and FDXC modem protocols. This selection is ignored by FDXA modem protocol.*

Answerback Message

You can store an answerback message in the computer while in any of the major headings. (The computer remembers your current major heading.) Start by typing <**Shift/A**>. The terminal responds by displaying AUTO-ANSBK and A = on the monitor, as shown in Figure 2-6. Next, type a delimiter, which may be any character, followed by your message of up to 20 characters. (The delimiter is not sent as part of the message.)

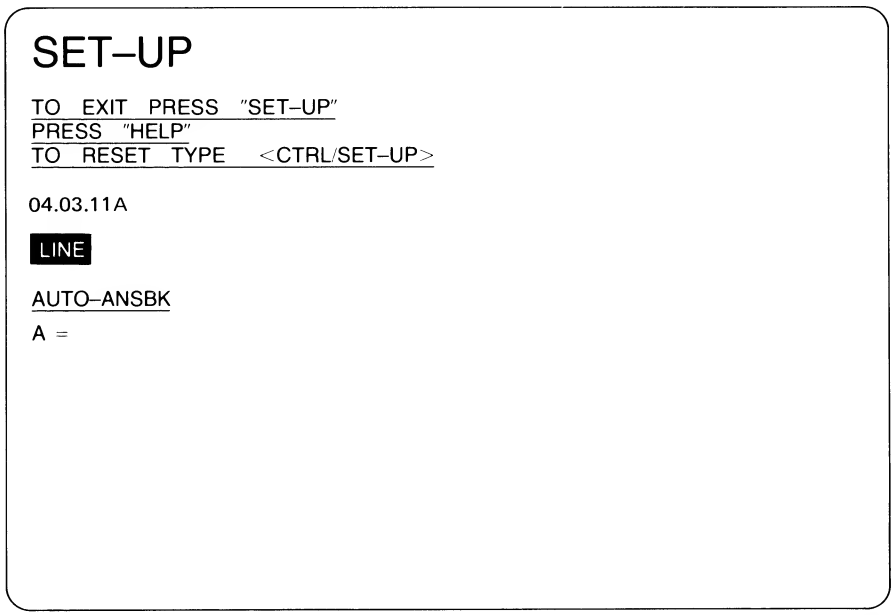
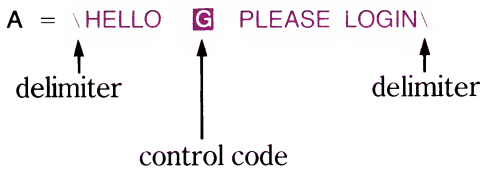


Figure 2-6. Set-Up Display – Auto-Answerback

NOTE: *You may use control characters, such as <Ret>, in the message. A control character is echoed on the monitor as a reverse-video-associated ASCII character. For example, a bell is a reverse-video G for <Ctrl/G>; a <Ret> is a reverse-video M.*

The message automatically terminates after you enter the 20th character. You may also end the message early by typing the same delimiter you started with. This will also return you to your current major heading.

Example:



You can correct an error in your message only by exiting answerback, reentering, and retyping the message. Beginning a message with two identical characters causes the message to be erased. To save the answerback message along with the other parameters, type <**Shift/S**>.

The saved answerback message cannot be displayed once it is stored in memory. The answerback message is transmitted to the remote computer when your Rainbow 100 computer receives an ENQ control code from the remote computer or an application. While in terminal mode, you can transmit the message by typing <**Ctrl/Break**>.

Modem Major Heading

This major heading allows you to set the features of the communications (COMM) connector, which is on the back of the system unit. This connector allows you to attach a communications cable to a telephone modem or to another computer. Select the Modem major heading by pressing <**Next Screen**>.

A typical Modem major heading is shown in Figure 2-7. You can change the selection by pressing the → or ← key, and change the value of that selection by pressing the ↑ or ↓ key.

Changing Modem Data Bits and Parity

This selection determines two separate but related communications features – data bits and parity. Information travels on the communications line according to

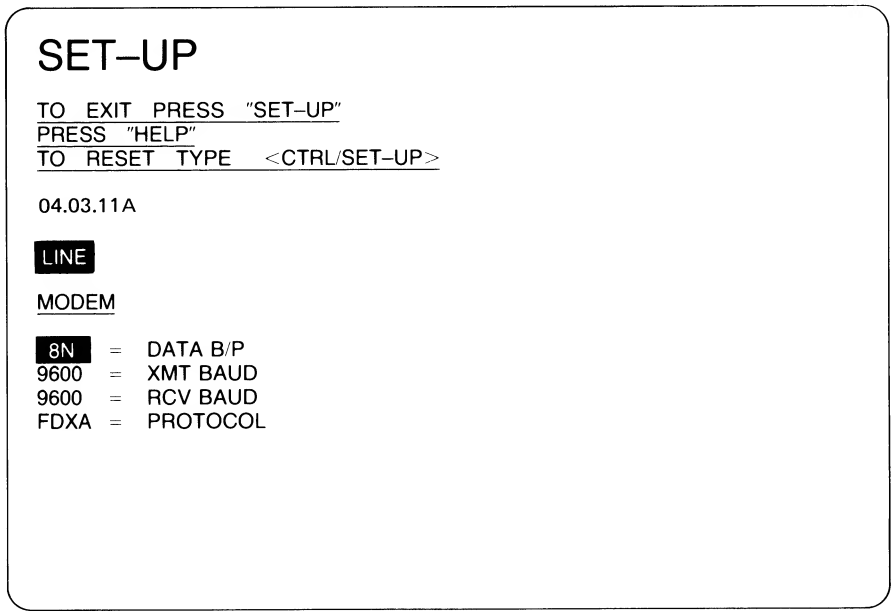


Figure 2-7. Set-Up Display – Modem

a data pattern. The pattern begins with a start bit, uses 7 data bits (common in the United States) or 8 data bits (common in Europe), adds a parity bit, and terminates with 1 or 2 stop bits. This selection determines if the computer is to use 7 or 8 data bits for each character and the type of parity to be used, as listed in Table 2-3. Press the ↑ or ↓ key to change the value to the selection needed.

Setting the Transmit Baud Rate

Press the → key to select the transmit baud rate, shown in Figure 2-7. This selection enables the speed (baud rate) at which characters are transmitted by the Rainbow 100 computer. (The current speed is shown in reverse video on the monitor.) This setting must match the receive speed of the remote computer. Press the ↑ or ↓ key to cycle through the following transmit baud rates. Stop when the baud rate needed is displayed.

50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800,
2000, 2400, 3600, 4800, 9600, 19200

Table 2-3. Modem and Printer Data Bits and Parity Selection

Characters Displayed	Data Bits per Character	Type of Parity upon Transmission	Action on Parity upon Reception
7O	7	Odd	Checked
7E	7	Even	Checked
7N	7	No parity	Ignored
7M	7	Mark	Ignored
7S	7	Space	Ignored
8O	8	Odd	Checked
8E	8	Even	Checked
8N	8	No parity	Ignored

Setting the Receive Baud Rate

Press the → key to select the receive baud rate, shown in Figure 2-7. The receive baud rate feature selects the speed of the characters coming from the communications line as expected by the Rainbow 100 computer. This speed must be set to match the transmit speed of the remote computer. Press the ↑ or ↓ key to cycle through the available receive baud rates, which are the same as the choices listed above for the transmit baud rate. You can set a receive baud rate different from the transmit baud rate as long as the remote computer is set to match these different rates.

Setting Modem Protocol

This selection applies only to terminal mode. The rules for communications, the signals used, and how the signals are interpreted all form the communications protocol. Press the → key to select the modem selection parameter shown in Figure 2-7. The protocol selected determines the method used to disconnect a telephone line. Press the ↑ or ↓ key to cycle through the available modem protocols, listed in Table 2-4. The modem protocols are explained in more detail in Chapter 4.

Table 2-4. Modem Protocols

Characters Displayed	Modem Protocol Selected
FDXA	Full-duplex, no modem (data leads only) with or without auto-XON/XOFF control
FDXB	Full-duplex, full modem control with or without auto-XON/XOFF control
FDXC	Asymmetrical full-duplex with modem control (requires a special cable)

Printer Major Heading

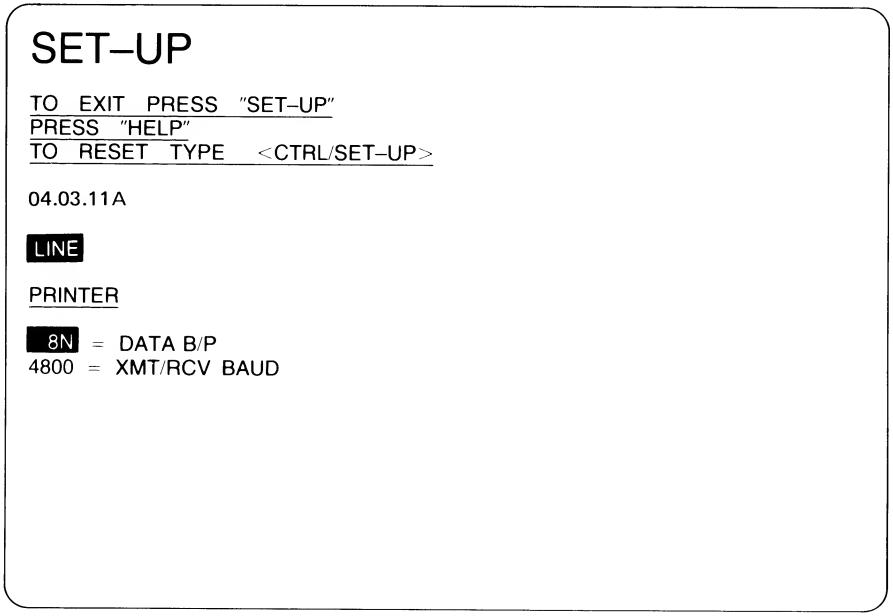
The Printer major heading, shown in Figure 2-8, allows you to set the communications settings for the PRINTER connector, which is on the back of the system unit. This connector allows you to connect a printer, such as Digital's LA50 Personal Printer, LA100 Letterprinter 100, or LQP02 Letter-Quality Printer, to your Rainbow 100 computer. The communications settings of the printer connector must be set to match the settings on your printer. The Printer major heading has two minor headings:

- Data bits/parity
- Transmit/receive baud rate

The minor heading selected is shown in reverse video on the monitor. You can change the minor heading by pressing the → or ← key, and the values of each minor heading by pressing the ↑ or ↓ key.

Setting Printer Data Bits and Parity

This minor heading selects the data bits per character for the printer, and also selects the parity of the data pattern. When selected, the current setting of this minor heading is shown in reverse video. Press the ↑ or ↓ key to cycle through the available selections, listed in Table 2-3. Stop when the selection needed is displayed. Your selection must be set to match the settings of your printer.



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Figure 2-8. Set-Up Display – Printer

Setting Printer Transmit/Receive Baud Rate

Press the → key to select the transmit/receive baud rate minor heading, shown in Figure 2-8. When selected, the current setting of the baud rate (speed) is shown in reverse video. Press the ↑ or ↓ key to cycle through the following baud rates. Stop when the displayed baud rate matches the baud rate set on your printer.

Baud Rate	Stop Bits
75	2
150	1
300	1
600	1
1200	1
2400	1
4800	1
9600	1

Table 2-5 lists the range of baud rates for the printers referred to above.

Table 2-5. Baud Rates for Digital's Personal Printers

Printer	Factory Set Baud Rate	Available Range
LA50 Personal Printer	4800	110 to 4800
LA100 Letterprinter 100	4800	50 to 9600
LQP02 Letter-Quality Printer	4800	110 to 9600

Miscellaneous Major Heading

Press <**Next Screen**> to select the Misc major heading, shown in Figure 2-9. Use this heading to select the scroll rate for smooth scrolling, the keyboard bell volume, and the keyclick volume. Set each of these to your own preference. These features are further described in the *Rainbow™ 100 User's Guide.*

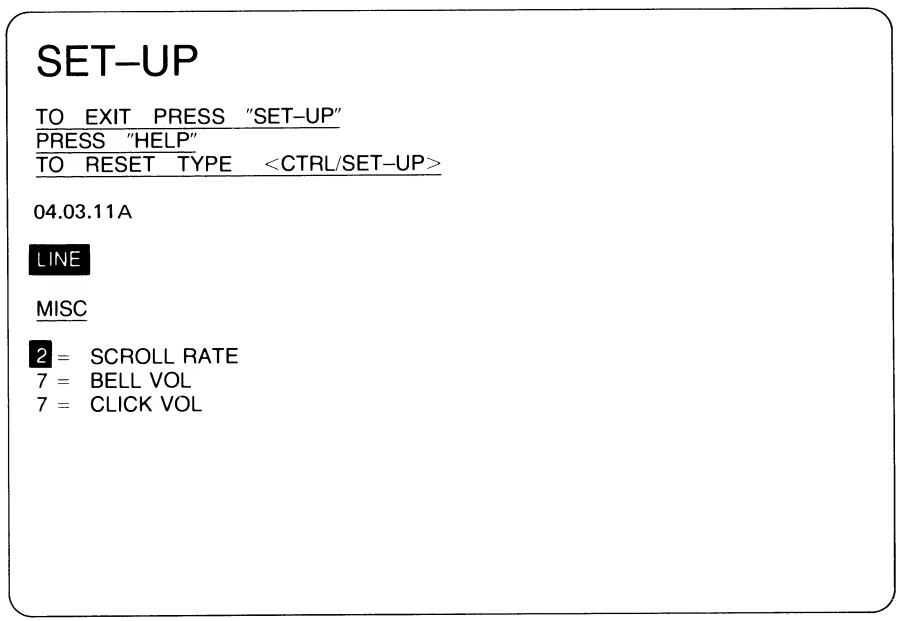


Figure 2-9. Set-Up Display – Misc(ellaneous)

Memory Major Heading

Press <**Next Screen**> to select the Memory major heading, shown in Figure 2-10. Use this heading when you install the Rainbow 100 memory extension option to let the computer know you have changed the size of its memory.

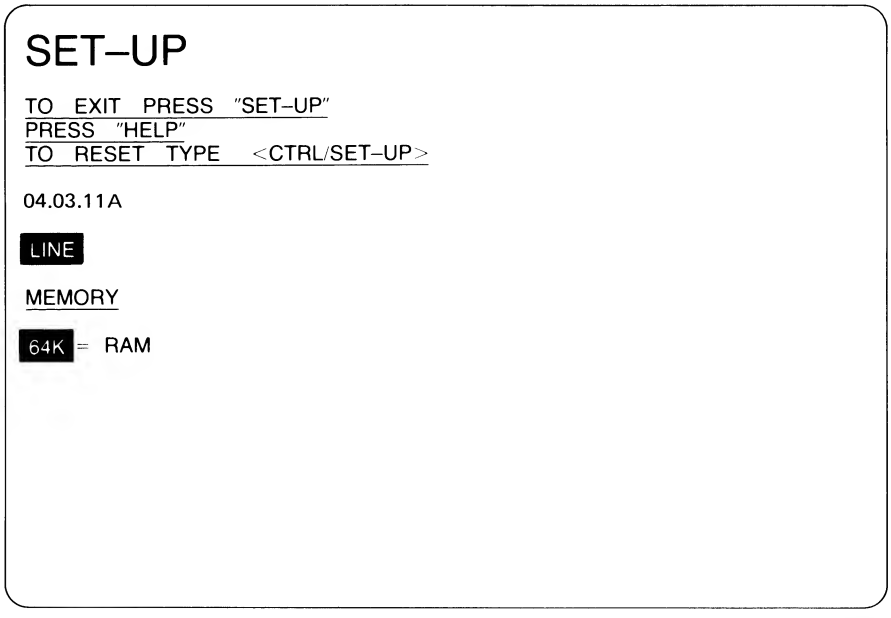


Figure 2-10. Set-Up Display – Memory

The Rainbow 100 computer has a standard memory size of 64K bytes. (The K stands for 1024; a byte represents 1 character position.) Adding the 64K memory extension option makes the total memory equal to 128K bytes. Adding the 192K memory extension option makes the total memory equal to 256K bytes.

Saving Set-Up Values

IMPORTANT: To save the values you have selected in Set-Up, hold down the ***Shift*** *key and type* ***S****. This action places the values you have selected in a memory that preserves them for the computer when the power is turned off and on.*

Recalling Set-Up Values

When you change one or more Set-Up features, the computer uses the new values even if you have not saved them by pressing <**Shift/S**>. However, the values previously saved will be recalled when you turn off the power, execute a system reset, or when you recall the Set-Up values by pressing <**Shift/R**>.

CAUTION: The recall action erases any text you may have had on the monitor before you entered Set-Up.

Default Set-Up Values

When your computer was delivered from the factory, its Set-Up features were set to specific values called default values. The Parameter Settings default values are shown in Figure 2-4. To recall these default values, press <**Shift/D**>. The default values are not saved, they are just loaded into the operating memory.

NOTE: Recalling the default Set-Up values also recalls the default communications baud rates, data bits, and parity for both the COMM connector and the PRINTER connector.

CAUTION: Recalling the default Set-Up values erases any text you may have had on the monitor before you entered Set-Up.

Executing System Reset

While in Set-Up, press <**Ctrl**> and <**Set-Up**> at the same time to execute a system reset. The computer performs a brief selftest of its main memory, recalls its Set-Up features, and displays its Main System Menu.

If an error is found and you can still operate the system in one of its operating modes, either as a terminal or as a personal computer (but not both), an error message appears on the monitor above the Main System Menu.

If an error message appears but no menu is displayed, you must find and correct the error before continuing. See Appendix B for a list of the error messages and their corrective actions.

3

Connecting a Printer to Your Rainbow 100 Computer

Introduction

Digital Equipment Corporation offers you a choice of three printers for your Rainbow 100 computer:

- LA50 Personal Printer
- LA100 Letterprinter 100
- LQP02 Letter-Quality Printer

These printers, shown in Figure 3-1, will accept various types of paper, including fan-fold paper, multipart forms, roll paper, labels, and your own office stationery.

Each of these printers is easily connected to your Rainbow 100 computer. Other of Digital's serial printers with the same FCC rating may also be connected to your Rainbow 100 computer. (See the notice on this manual's copyright page.)

Connecting a Printer to Your Rainbow 100 Computer

The printer connector is a D-type, 25-pin, female connector on the back of the Rainbow 100 system unit, as shown in Figure 3-2. Use the following procedure to connect a printer to your system unit.

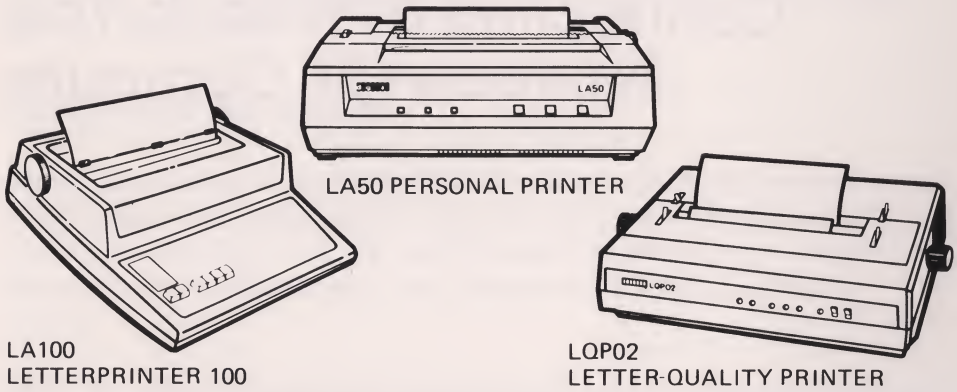


Figure 3-1. Digital's Personal Printers

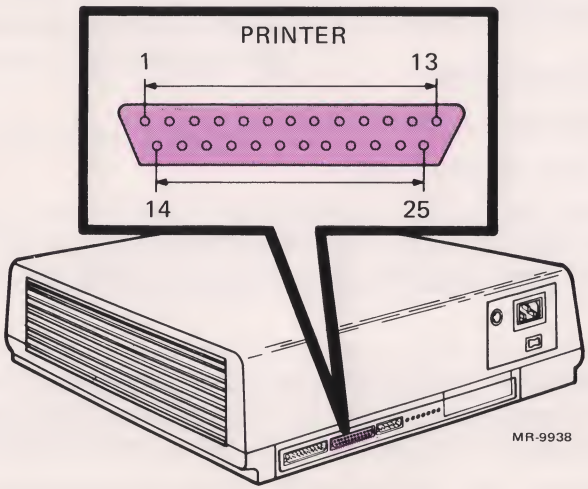


Figure 3-2. Printer Connector on the System Unit

1. Set the power switch (marked 1/0) on the front of your system unit to 0 (off).
2. If your system unit is installed in the optional floor stand, open the door on the back of the floor stand to access the back of the system unit.
3. Connect the male plug of a BCC04 printer cable to the female connector on the back of the system unit. Refer to Figure 3-3 if you are not using the optional floor stand, or Figure 3-4 if you are. Tighten the cable's hold-down screws with your fingers or a screwdriver. (Do not use a null-modem cable.)
4. Close the door on the floor stand (if applicable).
5. Connect the other end of the BCC04 printer cable to the back of the printer and tighten the cable's hold-down screws.
6. At this point, to complete installation of the printer, its ribbon, and paper, refer to the printer's installation manual.
7. Plug one end of the printer's power cord into the back of the printer and the other end into a wall receptacle.
8. Turn on the printer.
9. Turn on the Rainbow 100 computer.

Printer Set-Up Selections

You can change the following selections in the Rainbow 100 computer for different types of printers.

- Number of data bits per character – 7 or 8
- Parity – odd, even, mark, space, or none
- Transmit/receive speed (baud rate)

Changing Data Bits and Parity

Turn on the Rainbow 100 computer and wait for the Main System Menu to appear. Press <**Set-Up**>. Then press <**Next Screen**> until the Printer major heading appears, as shown in Figure 3-5.

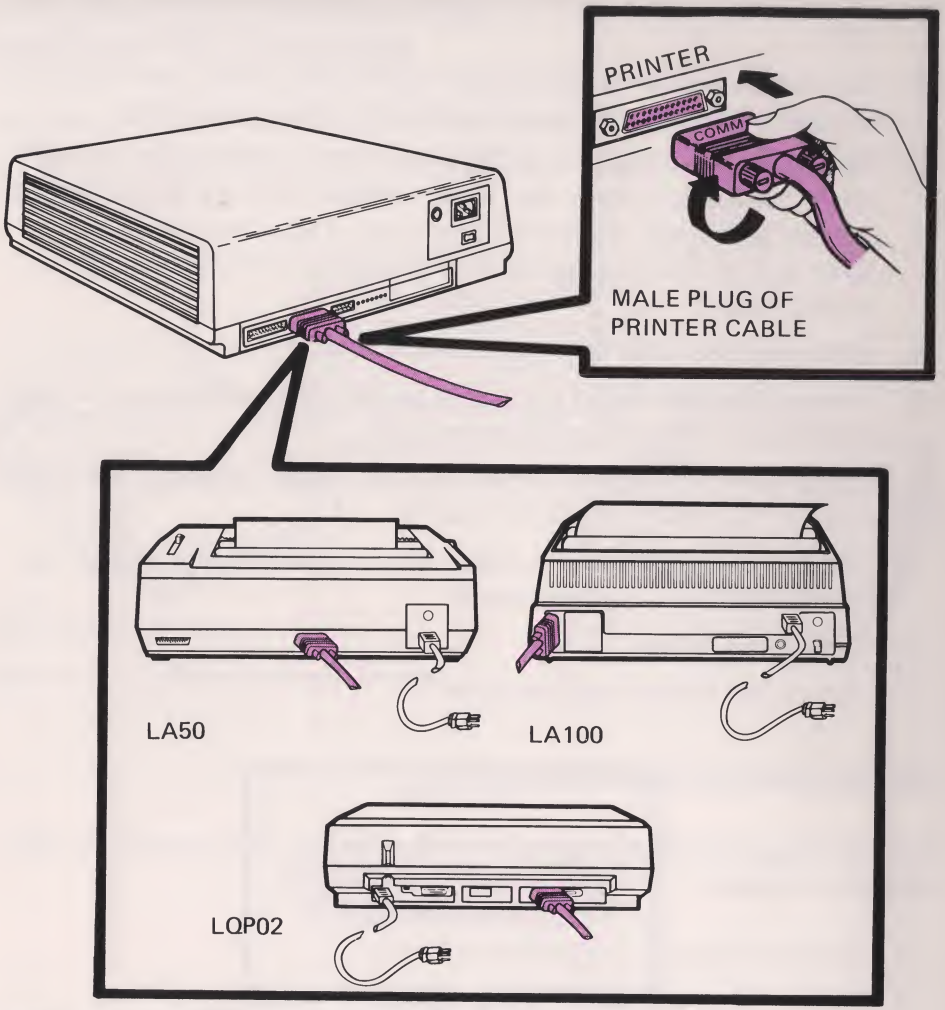


Figure 3-3. Connecting a Printer to the System Unit (without Floor Stand)

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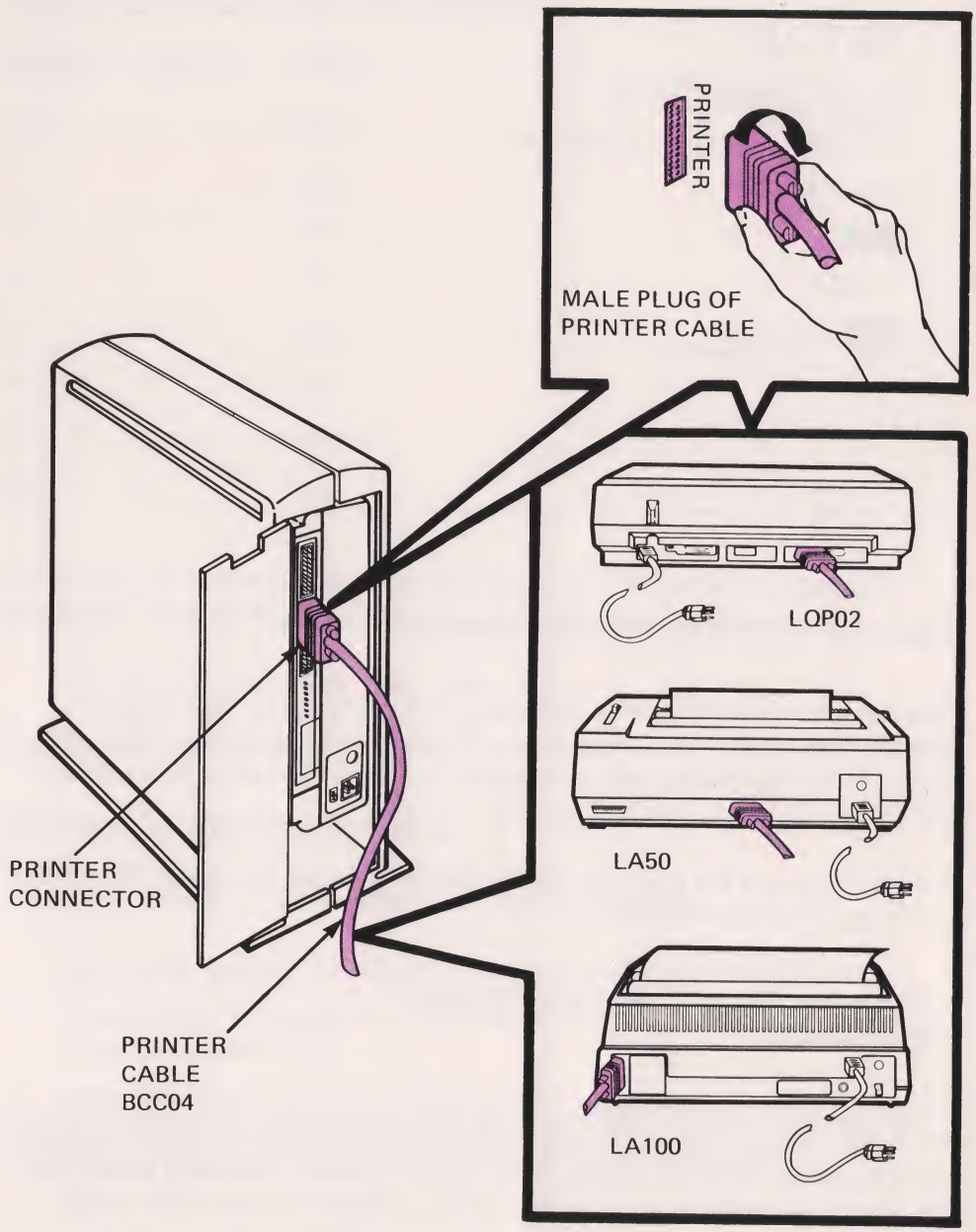
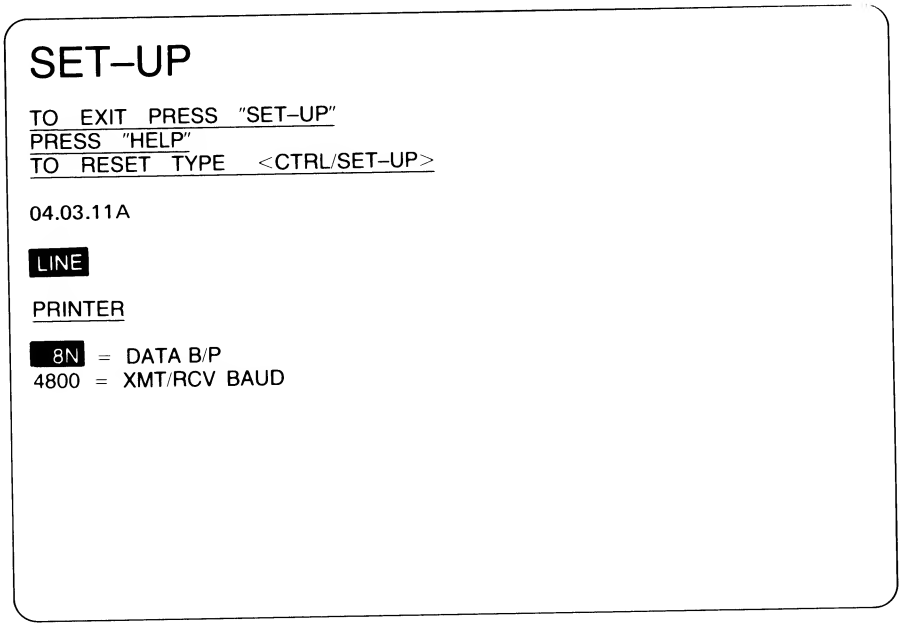


Figure 3-4. Connecting a Printer to the System Unit in the Floor Stand

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Figure 3-5. Printer Major Heading in Set-Up

The current setting of the data bits and parity is shown in reverse video. If needed, press the ↑ or ↓ key to change this setting to match that of the printer. Digital's personal printers are sent enabled for 8 data bits and no parity. Other possible settings are listed in Table 3-1.

If 8-bit characters are selected, the last data bit is forced to a space (0) condition and is ignored when received.

Changing Transmit/Receive Speed (Baud Rate)

Press the → key on the Rainbow 100 keyboard to select the transmit/receive baud rate. When selected, the rate's current setting is shown in reverse video on the monitor. If you are using a printer other than one mentioned in this manual, check the printer's user's guide to find its standard transmit and receive speed.

Table 3-1. Printer Data Bits and Parity Selections

Setting	Data Bits	Parity
7M	7	Mark
7S	7	Space
7O	7	Odd
7E	7	Even
7N	7	None
8O	8	Odd
8E	8	Even
8N	8	None

Press the ↑ or ↓ key to change this setting on the Rainbow 100 computer to match that of the printer. The following baud rates are supported.

75, 150, 300, 600, 1200, 2400, 4800, 9600

Exit Set-Up by pressing <**Set-Up**>.

Printer Connector Signals

The printer connector signals meet the following standards.

- Electronic Industry Association (EIA) standard RS-423 and RS-232-C
- International Telegraph and Telephone Consultative Committee (CCITT) recommendation V.28

The printer connector signals and their pin assignments are listed in Table 3-2. Signals and pins not listed are not used by the Rainbow 100 computer.

Table 3-2. Printer Connector Signals

Pin	Signal	Name	CCITT/EIA	Description
1	Protective Ground	PROT GND	101/AA	Chassis ground; ac power cord ground.
2	Transmitted Data (Input)	TXD	103/BA	XON/XOFF control signals and other characters from the printer.
3	Received Data (Output)	RXD	104/BB	Data received by the printer from the Rainbow 100 computer. This signal is asserted high (mark state) when not in use.
5	Clear to Send	CTS	106/CB	Always asserted high (mark state).
6	Data Set Ready	DSR	107/CC	Always asserted high.
7	Signal Ground	SGND	102/AB	Common ground for all signals.
20	Data Terminal Ready	DTR	108.2/CD	This signal from the printer indicates its status.

4
Communications

Introduction

This chapter describes how the Rainbow 100 computer communicates with a remote computer either by a telephone line (and modem) or by direct connection, as shown in Figure 4-1. In either case, the communications connector (labeled COMM) on the back of the system unit is used. This chapter defines the signals transmitted through this connector and how, in the case of a telephone connection, each modem protocol (as selected in Chapter 2) uses these signals. This chapter applies to the Rainbow 100 computer's terminal mode.

Connecting Your Rainbow 100 Computer to a Remote Computer

When using a telephone line, a modem (data set) is needed. The modem changes the signals produced by the Rainbow 100 computer into signals that can be transmitted over the telephone line. Many types of modems are available, but the modems on both ends of the telephone line must be compatible with each other.

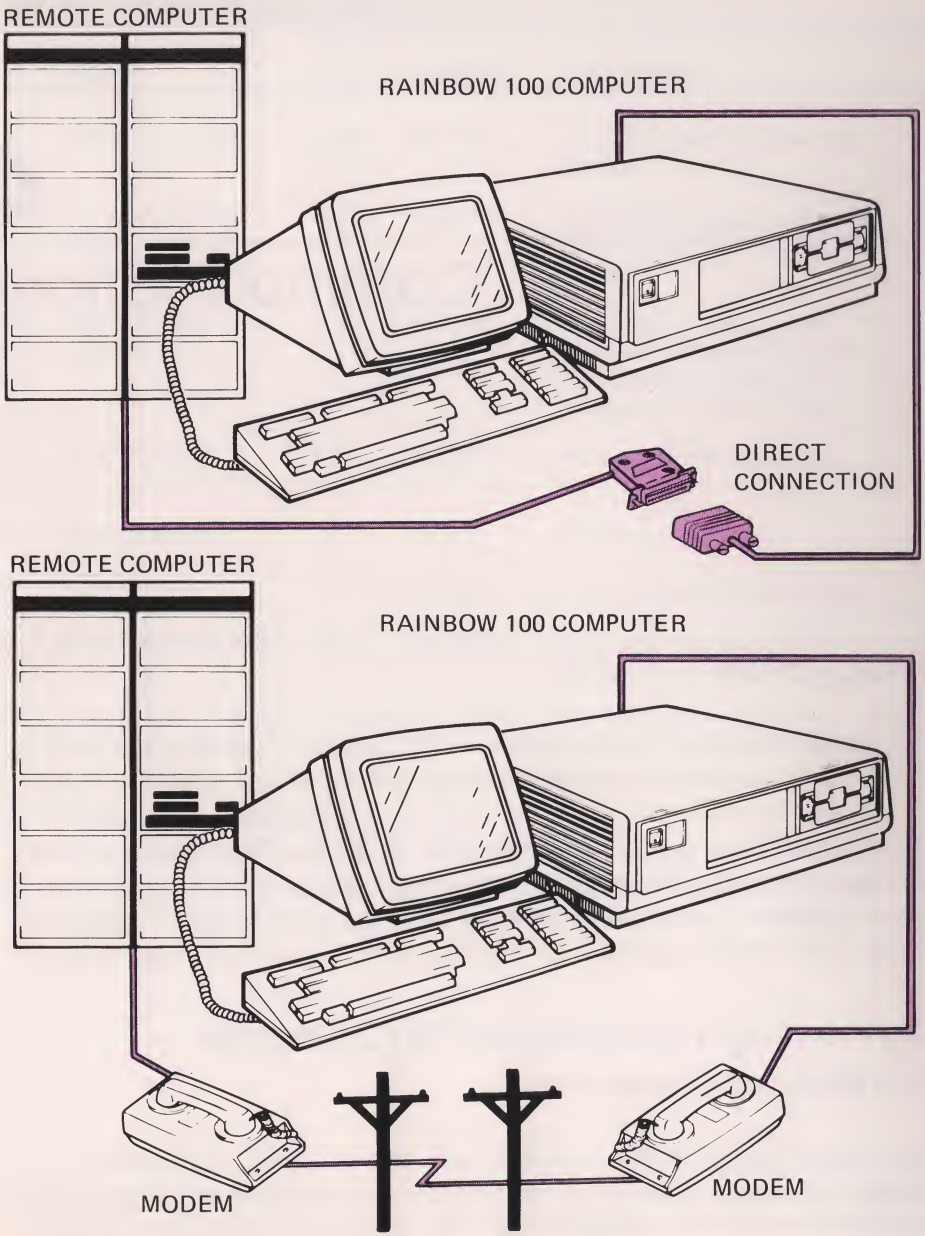


Figure 4-1. Connecting the Rainbow 100 Computer to a Remote Computer

Cables

Cables used to connect the communications connector with most asynchronous, Bell System-type modems must be asynchronous modem cables with an RS-232 female connector on one end and a corresponding male connector on the other. Digital's BCC04 modem cable meets these requirements.

Cables used to connect the communications connector with most synchronous, Bell System-type modems must be synchronous modem cables with an RS-232 female connector on one end and a corresponding male connector on the other. Digital's BC22C modem cable meets these requirements. (Synchronous communications requires a special application program.)

Different cables may be required by other serial devices. Check with the devices' vendors for more information.

Connection

Use the following procedure to connect the Rainbow 100 computer to a modem.

1. Set the power switch (marked 1/0) on the front of your system unit to 0 (off).
2. If your system unit is installed in the optional floor stand, open the door on the back of the floor stand to access the back of the system unit.
3. Connect the female connector of the modem cable to the communications connector (COMM) on the back of the system unit. Refer to Figure 4-2 if you are not using the optional floor stand, or Figure 4-3 if you are. Tighten the cable's hold-down screws.
4. Connect the other end of the modem cable to the modem and tighten the cable's hold-down screws.
5. Close the door on the floor stand (if applicable).
6. Connect the modem's ac power cord to a wall receptacle. If the modem has a power on/off switch, turn on the modem.
7. Turn on the Rainbow 100 computer.

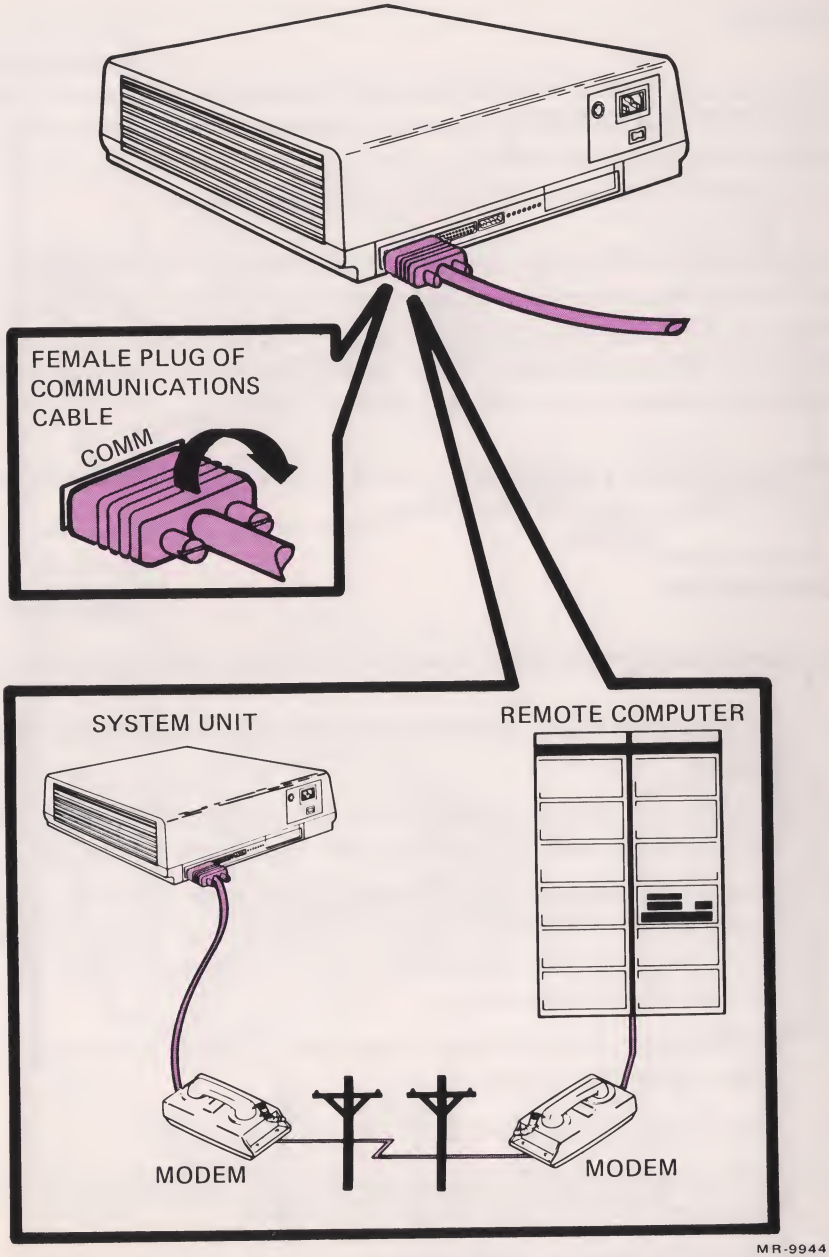


Figure 4-2. Connecting a Communications Cable to the System Unit (without Floor Stand)

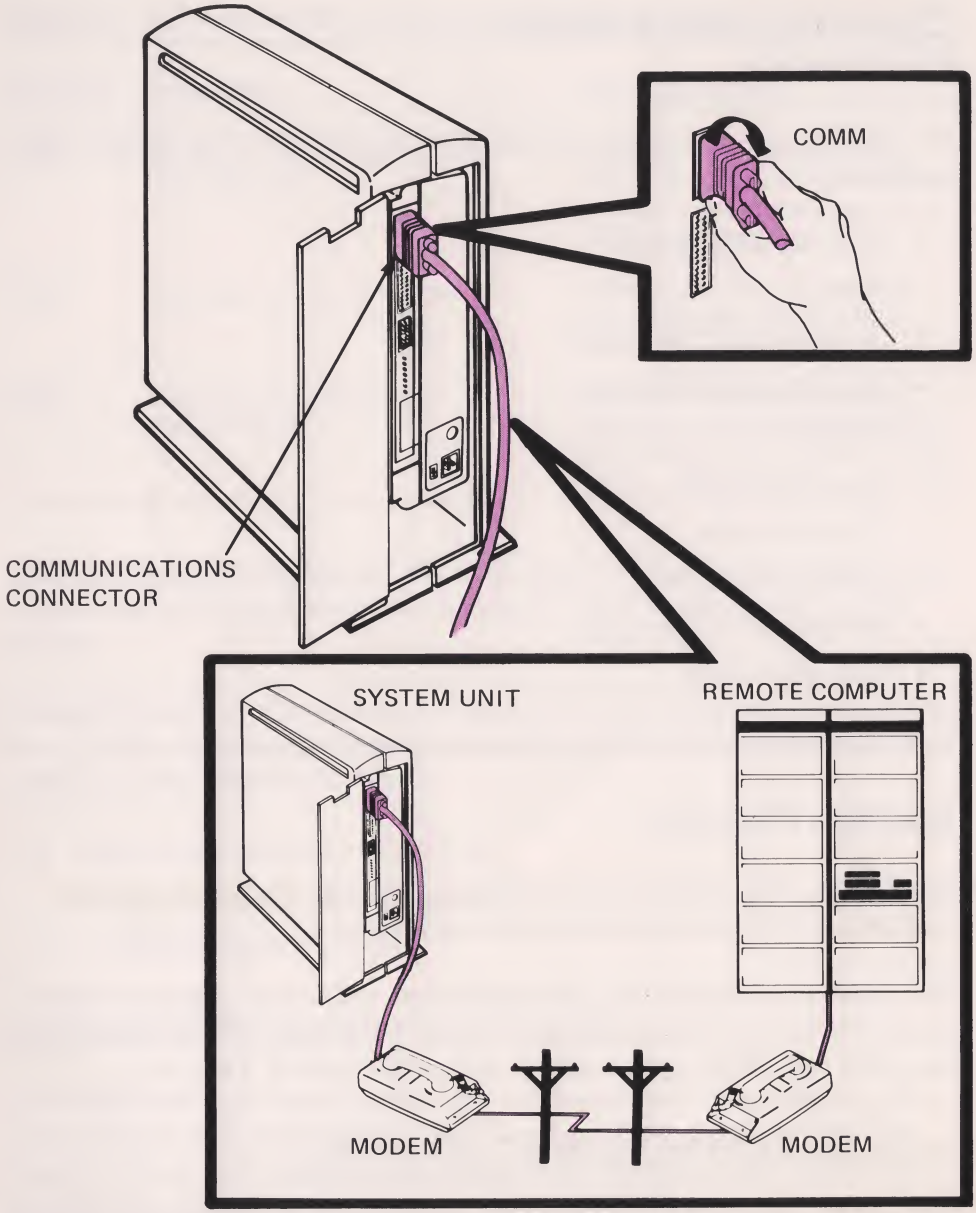


Figure 4-3. Connecting a Communications Cable to the System Unit in the Floor Stand

Communications Set-Up Parameters

You can change the following communications parameters on the Rainbow 100 computer.

- Data bits per character
- Parity
- Transmit speed (baud rate)
- Receive speed (baud rate)
- Protocol
- Auto-XON/XOFF
- Transmit break
- Character stop bits
- Received character parity
- Disconnect delay

Refer to Chapter 2 for directions on setting these parameters.

Modem Protocol

The Rainbow 100 computer uses a full-duplex modem. A full-duplex modem transmits and receives characters at the same time.

The rules for communications, the signals used, and how the signals are interpreted all form the communications protocol. In the Rainbow 100 computer you can select one of three communications protocols, listed in Table 4-1.

Full-Duplex with No Modem Control (FDXA)

The FDXA selection allows the Rainbow 100 computer to communicate without using modem control signals. The computer is ready to transmit or receive when its power is turned on and it is on-line.

Table 4-1. Communications Protocols for Terminal Mode

Selection	Description	Usual Application
FDXA	Full-duplex with no modem control (data leads only)	Full-duplex communications with direct connection to a remote computer or with a modem that does not use modem control signals.
FDXB	Full-duplex with modem control	Full-duplex communications with a modem that uses modem control signals.
FDXC	Asymmetrical full-duplex with modem control	Full-duplex communications with a half-duplex modem using the secondary channel. FDXC requires a special cable.

FDXA Connect Conditions. When the Rainbow 100 computer is turned on, it enables Data Terminal Ready and Request to Send. Communication is then allowed.

FDXA Disconnect Conditions. The Rainbow 100 computer disconnects the telephone line by turning off Data Terminal Ready. This signal is turned off when any of the following occurs.

- A disconnect character is received.
- A recall or system reset is executed.
- A <**Shift/Break**> is typed.

Full-Duplex with Modem Control (FDXB)

The FDXB selection allows the Rainbow 100 computer to communicate with a modem that uses modem control signals (such as Clear to Send and Data Set Ready). These control signals make sure that a connection occurs and is maintained before and during the communication process. Communication stops if the connection is not maintained.

FDXB Connect Conditions. The signals shown in Table 4-2 must be enabled before communication is allowed.

Table 4-2. Modem Connect Conditions

Name	Signal	Source
CTS	Clear to Send	Modem
DSR	Data Set Ready	Modem
RLSD	Receive Line Signal Detector (Carrier Detect)	Modem
DTR	Data Terminal Ready	Rainbow 100 Computer

FDXB Disconnect Conditions. The Rainbow 100 computer disconnects the telephone line by turning off Data Terminal Ready. This signal is turned off when any one of the following occurs.

- The Rainbow 100 computer is placed off-line.
- A recall or system reset is executed.
- A disconnect <**Shift/Break**> is enabled.
- A disconnect character is received, and the disconnect character enable Set-Up selection is on.
- Data Set Ready is turned off.
- There is a loss of RLSD for a time more than allowed by the disconnect delay Set-Up selection.
- RLSD is not turned on within 30 seconds after DSR is turned on.

Asymmetrical Full-Duplex (FDXC)

The FDXC selection allows the Rainbow 100 computer to use full-duplex communications on a half-duplex modem. The Rainbow 100 computer receives characters on the primary channel at 600 or 1200 baud and transmits characters on the secondary channel at 75 baud. The Secondary Clear to Send and Secondary Request to Send signals are used instead of Clear to Send and Request to Send, respectively.

The modem must support a secondary channel to use this protocol, and a special cable that connects the secondary transmitting signals from the modem to the primary transmitting signals of the Rainbow 100 computer is required.

FDXC Connect Conditions. The signals shown in Table 4-2 must be enabled before communication is allowed.

FDXC Disconnect Conditions. The Rainbow 100 computer disconnects the telephone line by turning off Data Terminal Ready. This signal is turned off under the same conditions specified above for FDXB.

Break

You can enable or disable the **Break** key by using the transmit break Set-Up selection. A Break signal is a transmitted space (0) condition that lasts 0.275 seconds (±10%) on the transmit data line. The remote computer's response to the Break signal depends on the type of computer and its software.

A disconnect <**Shift/Break**> can always be performed when the Rainbow 100 computer is in terminal mode and on-line. It turns off the Data Terminal Ready (DTR) and Request to Send (RTS) signals.

When the disconnect character enable Set-Up selection is on, the Rainbow 100 computer transmits the disconnect character before it turns off the DTR and RTS signals.

Typing <**Shift/Break**> is the usual way to disconnect the Rainbow 100 computer from its communications line.

Auto-XON/XOFF

For terminal mode, it is recommended that you have the auto-XON/XOFF Set-Up feature on. With this feature, the Rainbow 100 computer automatically sends an XOFF control character when it receives more characters than it can handle. The XOFF control character tells the remote computer to stop sending data. When the Rainbow 100 computer can accept more data, it sends an XON control character to the remote computer to tell it to continue transmitting data.

Communications Connector Signals

The communications connector signals meet the following standards.

- EIA RS-423 and RS-232-C
- CCITT recommendations V.21, V.22, V.23, V.24, and V.28

The communications connector's pin numbers are shown in Figure 4-4. The signals on each pin are listed in Table 4-3. This table also lists the signals used by each modem protocol. Signals and pins not listed are not used by the Rainbow 100 computer.

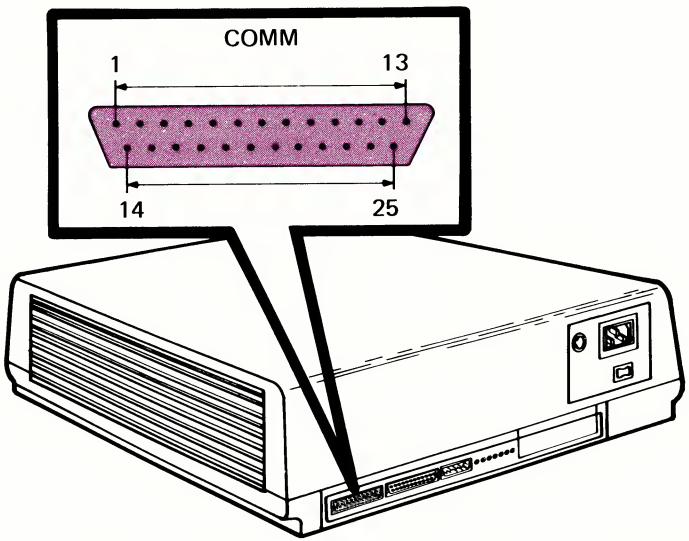


Figure 4-4. Communications Connector Pin Numbers

Table 4-3. Communications Connector Signals

Pin	Signal	Name	CCITT/EIA	FDXA	FDXB	FDXC	Description
1	Protective Ground	PROT GND	101/AA	X	X	X	Chassis ground; ac power cord ground.
2	Transmitted Data	TXD	103/BA	X	X	X	Data transmitted from the Rainbow 100 computer; asserted high (mark state) when not transmitting.
3	Received Data	RXD	104/BB	X	X	X	Characters received from the remote computer.
4	Request to Send	RTS	105/CA	X	X	X	On when the Rainbow 100 computer is on-line, and off when off-line.
5	Clear to Send	CTS	106/CB	X	X	X	Indicates the modem is ready for transmission.
6	Data Set Ready	DSR	107/CC	X	X	X	Indicates the modem is in data mode.
7	Signal Ground	SGND	102/AB	X	X	X	Common ground for internal circuits (except protective ground).
8	Receive Line Signal Detector (Carrier Detect)	RLSD	109/CF	–	X	X	The modem turns this signal on when the carrier signal is of sufficient quality and magnitude.
12	Speed Indicator	SI	112/CI	–	X	–	When on, the transmit and receive speeds are 1200 baud; when off, these speeds are as established in Set-Up.
13	Secondary Clear to Send*	SCTS	121/SCB	–	–	X	When on, the modem is ready for the Rainbow 100 computer to transmit data; when off, the modem is not ready.

X = Used with this protocol selection.
*These signals are supported by using a special cable for FDXC modem protocol.

Table 4-3. Communications Connector Signals (Cont)

Pin	Signal	Name	CCITT/EIA	FDXA	FDXB	FDXC	Description
14	Secondary Transmit Data*	STXD	118/SBA	–	–	X	Secondary channel information; same as Transmitted Data (TXD).
15	Transmitter Clock	TSET	114/DB	–	–	X	External clock from the modem.
17	Receiver Clock	RSET	115/DD	–	–	X	External clock from the modem.
19	Secondary Request to Send*	SRTS	120/SCA	–	–	X	When on, the Rainbow 100 computer is ready to receive characters; when off, the computer is ready to transmit characters. Same as Request to Send (RTS).
20	Data Terminal Ready	DTR	108.2/CD	X	X	X	When on, the Rainbow 100 computer is ready to receive data; when off, this signal causes the modem to disconnect and not answer calls.
22	Ring Indicator	RI	125/CE	–	–	–	Ignored; used by the modem.
23	Speed Select	SPDS	111/CH	–	X	–	When on, the Rainbow 100 computer's receive speed is greater than 600 baud; when off, the computer's receive speed is equal to or less than 600 baud.

X = Used with this protocol selection.
*These signals are supported by using a special cable for FDXC modem protocol.

5
System Tests

Diagnostic Tests

The Rainbow 100 computer runs two types of diagnostic tests that detect and isolate problems that may occur in the system.

1. An internal diagnostic test runs upon power-up, reset, or selftest.
2. A diskette diagnostic test runs a series of test programs that reside on a diskette.

The internal diagnostic test runs automatically upon power-up and checks the internal logic of the system. If this test runs successfully, the Main System Menu appears on the monitor, as shown in Figure 5-1, and the system bell tone sounds once.

If two bell tones sound, and an error message appears in flashing reverse video above the Main System Menu, as shown in Figure 5-2, only one of the computer's operational modes is working. For example, if a disk drive fails, you can still operate the Rainbow 100 computer as a terminal connected to a remote computer. If the communications line fails, you can still operate the Rainbow 100 computer as a personal computer. A complete list of error messages that can occur when you turn on the computer is found in Appendix B.



Figure 5-1. Main System Menu

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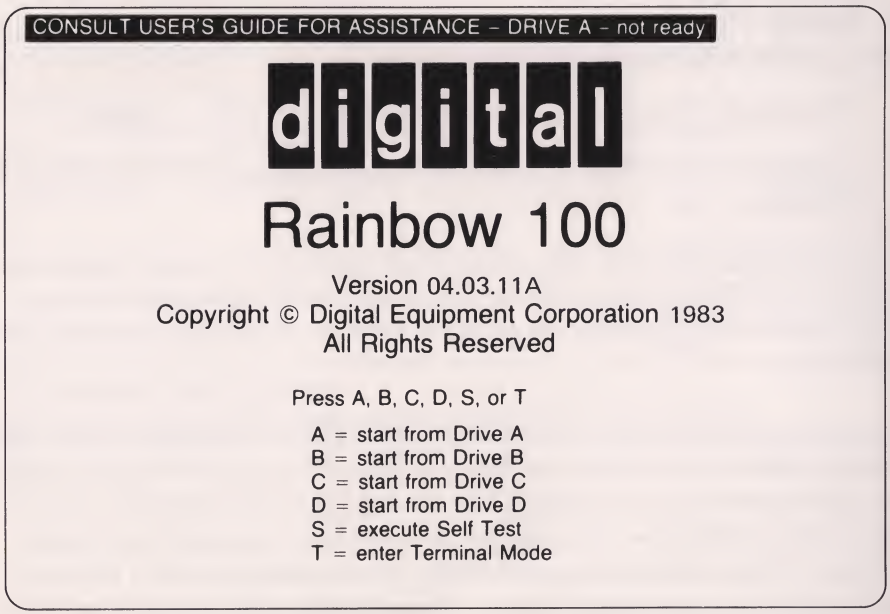


Figure 5-2. Main System Menu with Error Message

MR-9947

If three bell tones sound, an error message appears but the Main System Menu does not. In this case, you must find the cause of the error before you can continue. Refer to Chapter 6 and Appendix B and try to isolate the cause of the problem before calling for service. The error message will also be reported by the lights on the back of the system unit. For example, the "remove card or diskette" message is also displayed on the lights as shown in Figure 5-3.

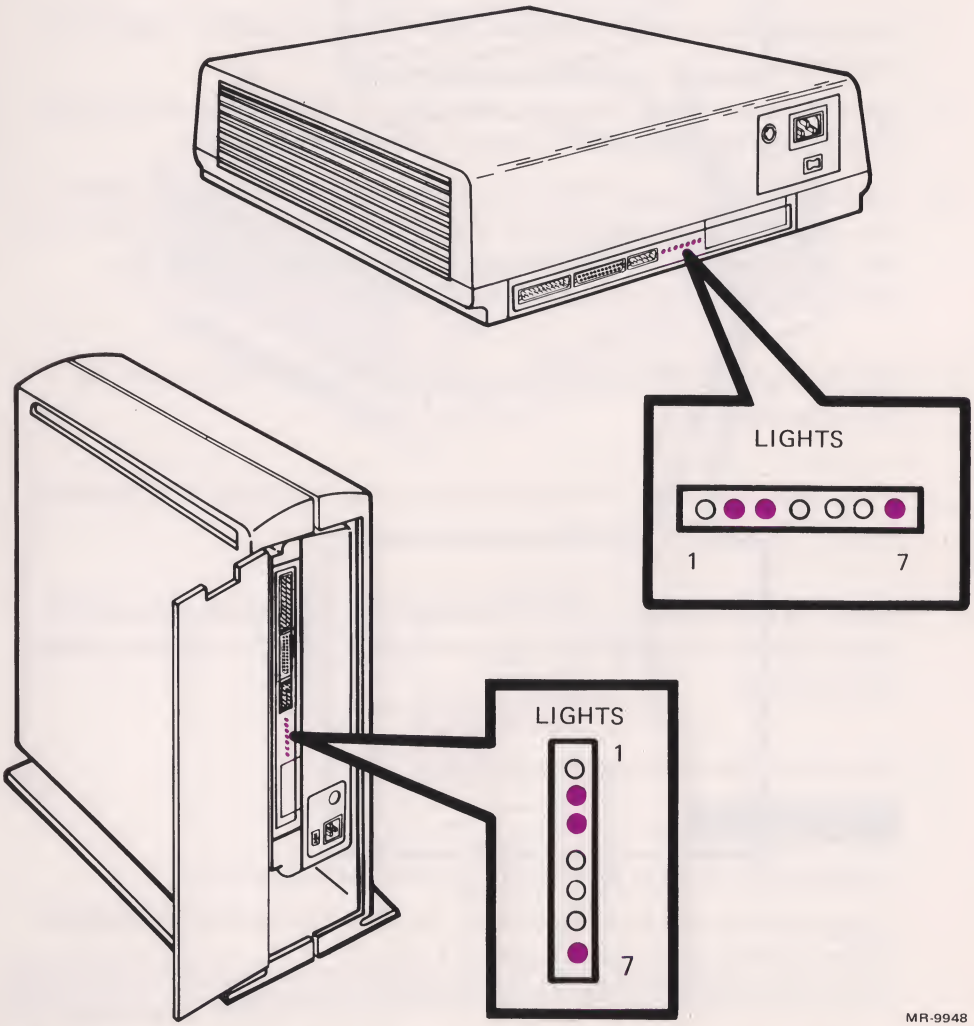


Figure 5-3. Example of an Error Message Displayed on the Lights at the Back of the System Unit

Extended Selftest

The extended selftest runs a more extensive internal diagnostic than that which is run upon power-up or reset. The extended selftest runs for 90 seconds. Run the extended selftest when you suspect a problem in the disk drive, a diskette, or any option added to the system module. Use the following procedure to run the extended selftest.

1. Turn on the Rainbow 100 computer. The Main System Menu appears on the monitor.
2. Open disk drive A and, if desired, disk drive B. Refer to Figure 5-4 if you are not using the optional floor stand, or Figure 5-5 if you are.
3. Load a blank or "scratch" diskette into disk drive A, as shown in Figure 5-6, and close its door. (A scratch diskette is simply one that has data on it that you do not care to save. The blank diskette's part number, BL-N402A-BK, is printed on the diskette's label.)

   NOTE: *Since this extended selftest only reads data from the diskette, the data is not destroyed.*

4. If you wish, load a blank or scratch diskette into disk drive B, as shown in Figure 5-7, and close its door.

   NOTE: *When inserting a diskette into drive B (and D for an optional disk drive), make sure the diskette's label faces down (or to the right when using the floor stand).*

5. Press the **S** key on the keyboard.

   TESTING. . .

   is displayed in reverse video on the monitor during the test.

   If the extended selftest is successful, the Main System Menu will appear on the monitor, as shown in Figure 5-1.

   If you typed A instead of S, you get the following message:

   CONSULT USER'S GUIDE FOR ASSISTANCE - non-system diskette

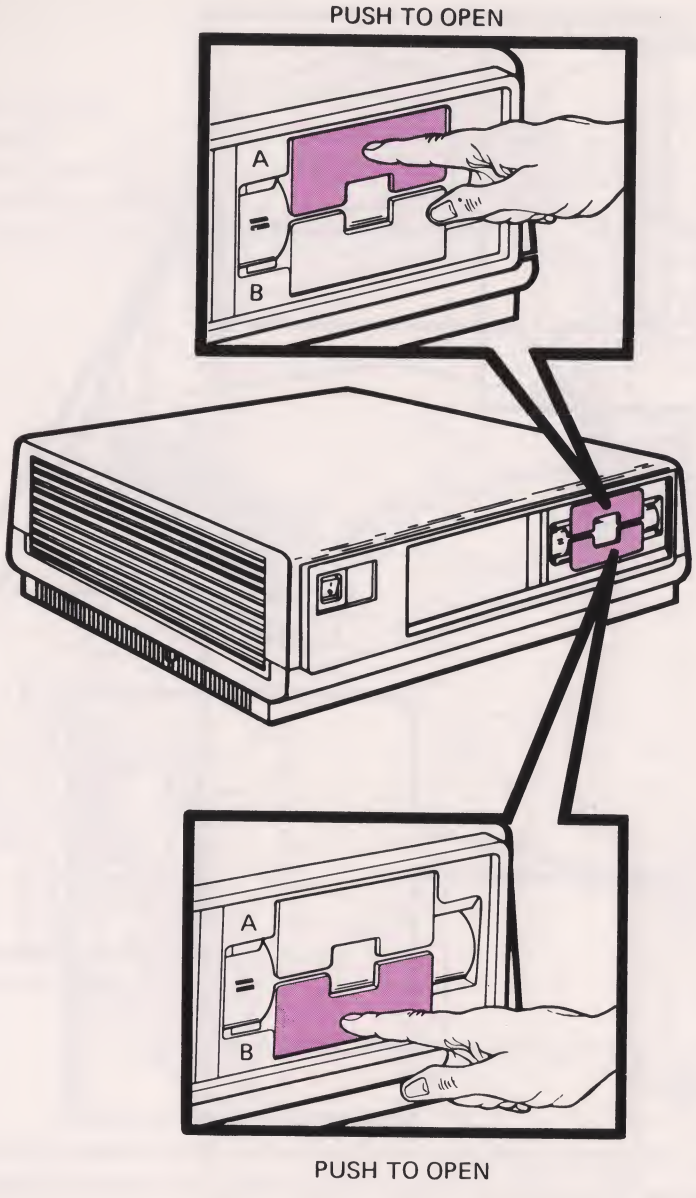


Figure 5-4. Opening the Disk Drive Doors When Not Using the Floor Stand

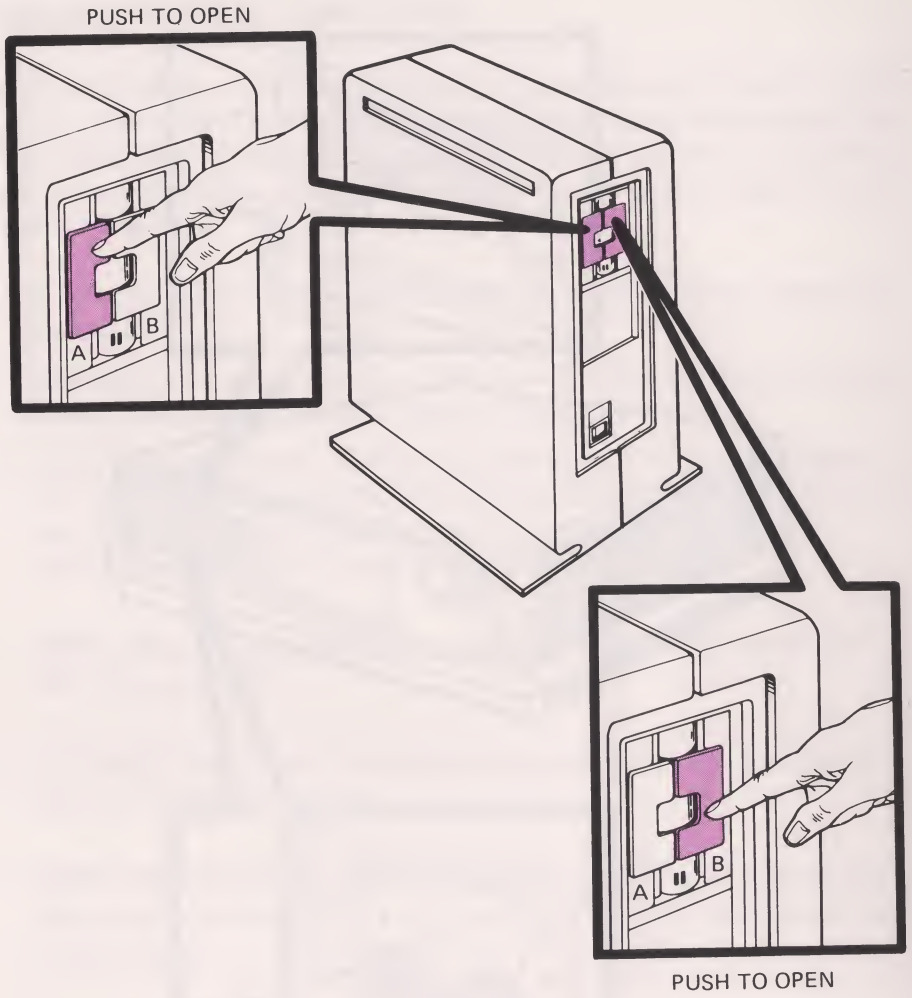


Figure 5-5. Opening the Disk Drive Doors When Using the Floor Stand

If you did not install a diskette into drive A, the following message appears, followed by the Main System Menu, as shown in Figure 5-2.

```
CONSULT USER'S GUIDE FOR ASSISTANCE - DRIVE A - not ready
```

Other errors that can occur during the extended selftest and the actions you must take to correct them are found in Appendix B.

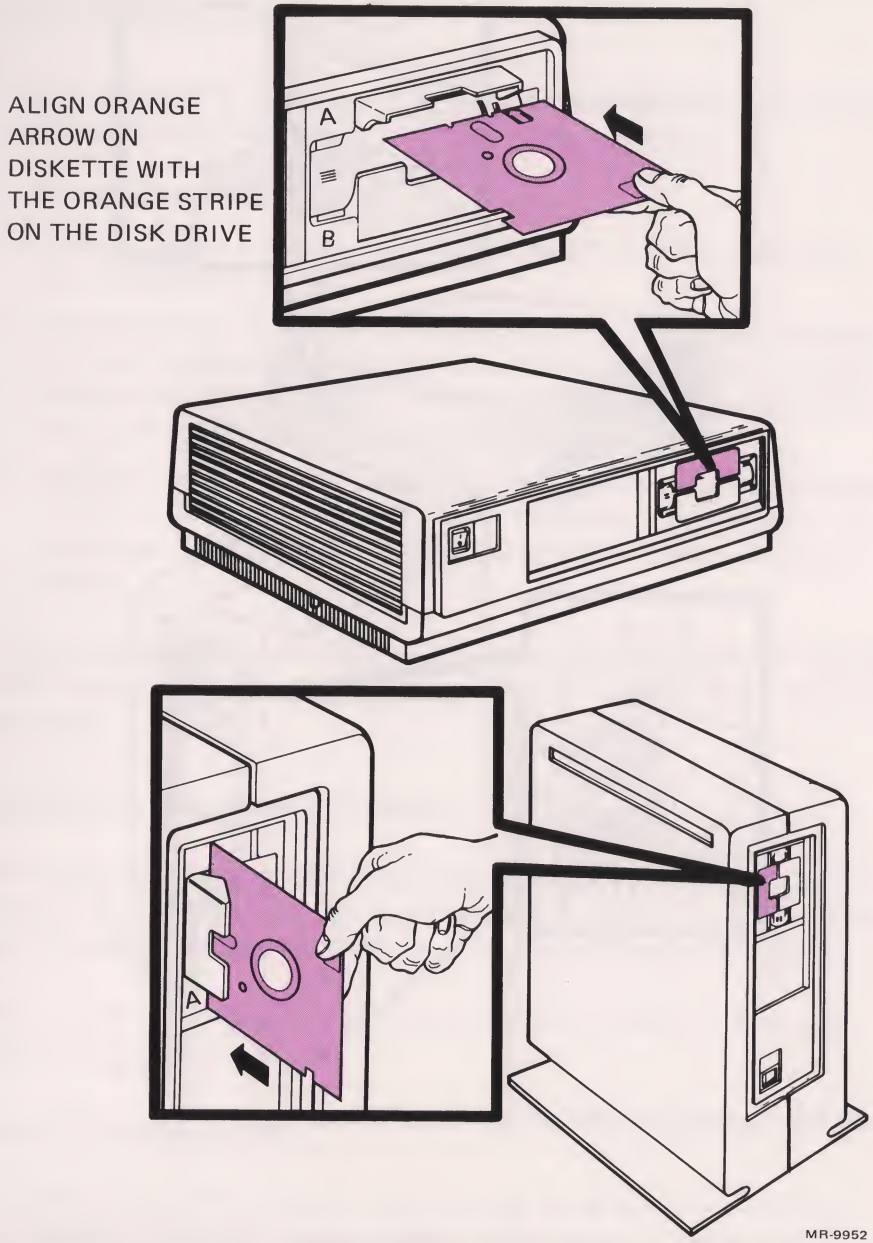


Figure 5-6. Loading a Diskette into Disk Drive A

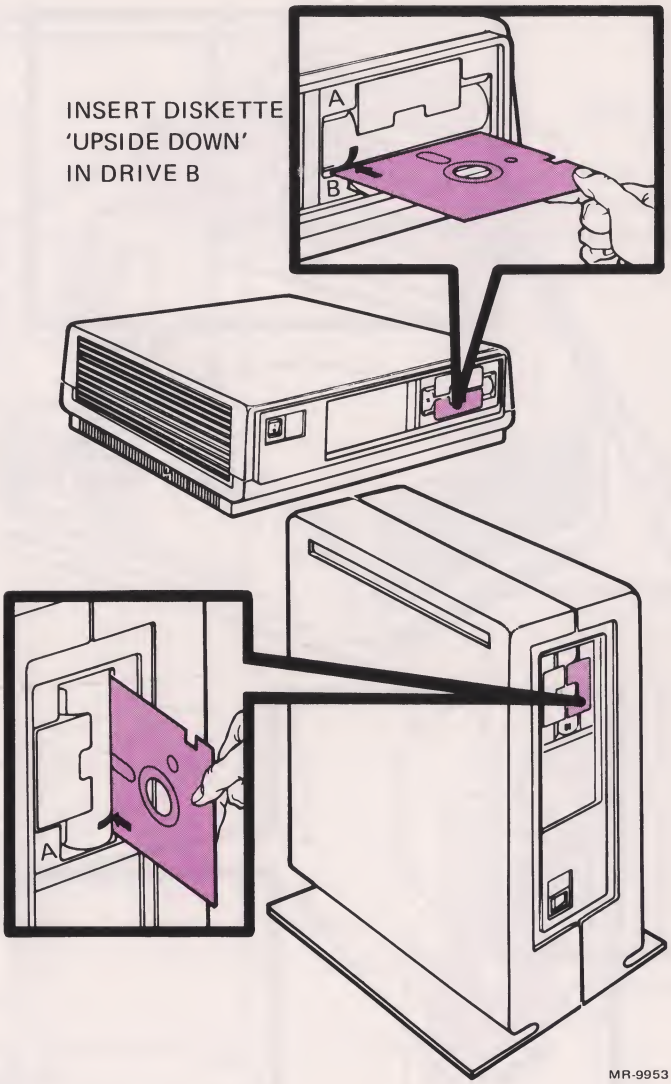


Figure 5-7. Loading a Diskette into Disk Drive B

Diskette Diagnostic Test

The Rainbow 100 diskette diagnostic test resides on one diskette. The diagnostic runs the following four programs.

1. Check drives A and B.
2. Check computer – This test runs the test above, a memory test, and a basic communications test.
3. Individual tests – This selection allows you to run the previous tests one at a time. In addition, it allows you to run tests that check the communications connector, the printer connector, and options. This selection is meant to help isolate a problem to a specific device.
4. Install new diagnostic test – This selection allows you to add new diagnostic tests to the diskette when you add new options to your system. Type **4** and press the **Return** key. Follow the directions that appear on the monitor.

The following paragraphs describe how to load the diagnostic diskette and select the desired test mode. The error messages for this diagnostic test are listed in Appendix B.

Loading the Diagnostic Diskette

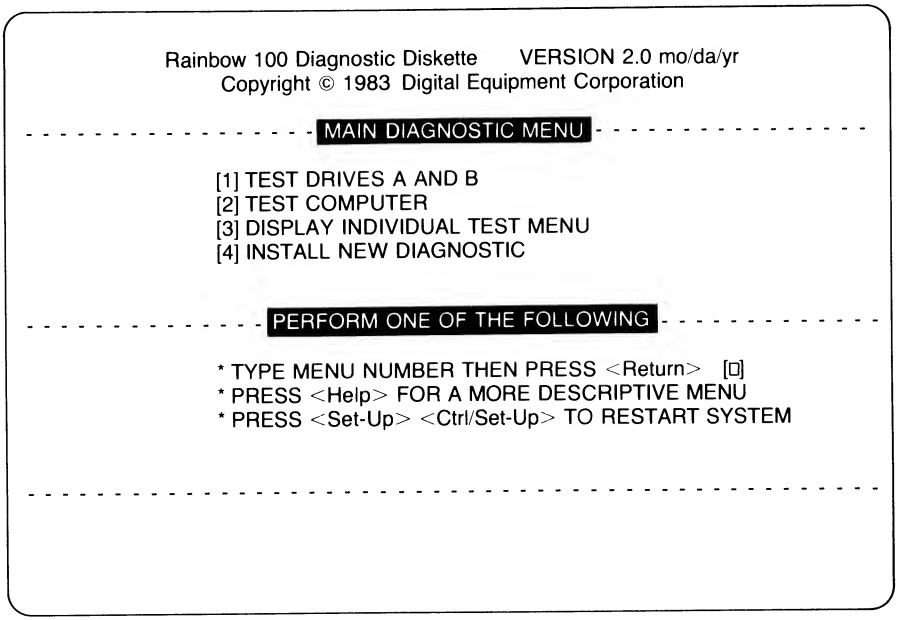
After turning on the system and the Main System Menu (shown in Figure 5-1) appears on the monitor, insert the diagnostic diskette into drive A and close its door. (Note that the diagnostic diskette can be started from any disk drive.)

Type **A** on the keyboard. The Main Diagnostic Menu, shown in Figure 5-8, appears on the monitor.

Check Drives A and B

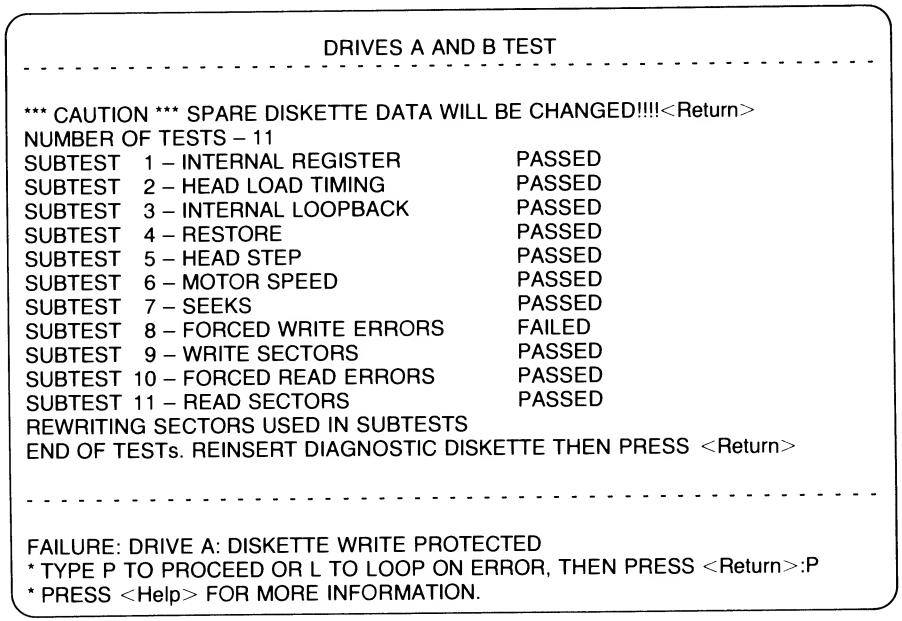
Check drives A and B by typing **1**, then pressing the **Return** key. The messages shown in Figure 5-9 begin to appear on the monitor. Type the response printed in color below. Note that <**Return**> means to press the **Return** key.

```
REMOVE DIAGNOSTIC DISKETTE AND INSERT SPARE DISKETTES
INTO DRIVES A/B <Return>
```



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Figure 5-8. Main Diagnostic Menu



MR-9956

Figure 5-9. Check Drives A and B

Remove the diagnostic diskette and insert blank or spare diskettes into drives A and B. Press <**Return**>.

NOTE: *When inserting the diskette into drive B (or D for an optional disk drive), make sure the diskette's label faces down (or to the right when using the floor stand).*

The following message prints on the monitor.

```
***CAUTION***SPARE DISKETTE DATA WILL BE CHANGED!!!! <Return>
```

Press <**Return**> if you want to continue.

If a problem is detected, an error message is displayed on the monitor. See Appendix B to isolate the cause.

After successful completion of the Drives A and B test, the following message is displayed on the monitor under the Main Diagnostic Menu.

```
PREVIOUSLY RUN DRIVES A AND B TEST -- PASSED
```

Test Computer (Extended Test)

Test the computer by typing **2**. The messages shown in Figure 5-10 begin to appear on the monitor. The subtest being executed is shown in reverse video.

After the Disk Drives subtest is completed, reinsert the diagnostic diskette and press <**Return**>.

The subtests check each disk drive, test the memory, and check the communications and printer connectors. An execution count number or a subtest execution time is displayed on the monitor. The message PASS or FAIL is displayed on the monitor after each test is completed, as shown in Figure 5-10.

After completion of the computer tests, the following message appears on the monitor after the Main Diagnostic Menu.

```
PREVIOUSLY RUN COMPUTER TEST -- PASSED (or FAILED)
```

```
DISK DRIVES          PASS      VIDEO                    - - - -
MEMORY (8088)        - - - -   COMM/PRINTER/KEYBOARD    - - - -
MEMORY (Z80)         - - - -   MEMORY (8088/Z80)        - - - -
MEMORY (SET-UP)      - - - -   SYSTEM INTERACTION       - - - -
= = = = = = = = = = = = = = = = COMPUTER TESTS = = = = = = = = = = = = = = = =
NUMBER OF TESTS - 11
SUBTEST  1 - INTERNAL REGISTER              PASSED
SUBTEST  2 - HEAD LOAD TIMING               PASSED
SUBTEST  3 - INTERNAL LOOPBACK              PASSED
SUBTEST  4 - RESTORE                        PASSED
SUBTEST  5 - HEAD STEP                      PASSED
SUBTEST  6 - MOTOR SPEED                    PASSED
SUBTEST  7 - SEEKS                          PASSED
SUBTEST  8 - FORCED WRITE ERRORS            PASSED
SUBTEST  9 - WRITE SECTORS                  PASSED
SUBTEST 10 - FORCED READ ERRORS             PASSED
SUBTEST 11 - READ SECTORS                   PASSED
REWRITING SECTORS USED IN SUBTESTS
END OF TESTs. REINSERT DIAGNOSTIC DISKETTE THEN PRESS <Return>

= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
```

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Figure 5-10. Extended Test Messages

Proceeding from an Error

If an error is detected during a diagnostic test, the following message appears after the error message.

```
*TYPE P TO PROCEED OR L TO LOOP ON ERROR,
THEN PRESS <Return>:
*PRESS  <Help>  FOR MORE ERROR INFORMATION.
```

If you type **L**, the message

```
--LOOPING ON ERROR: % ERROR = nnn
```

replaces the previous message. After the test is performed 10 times, the percent failure is updated. Type **P** to exit the loop, and proceed with the next test.

Typing **P** causes the next subtest to run. If you have proceeded from an error, at the completion of all subtests the Main Diagnostic Menu appears followed by:

```
PREVIOUSLY RUN COMPUTER TEST -- FAILED
```

After correcting the problem (for example, changing memory size in Set-Up), run the specific test that failed from the Individual Test Menu.

Individual Test Menu

Selecting **3** and pressing the **Return** key from the Main Diagnostic Menu displays the Individual Test Menu on the monitor, as shown in Figure 5-11.

Type the number of the test needed and press <**Return**>. Follow the instructions displayed on the monitor for that test.

After completion of the individual test selected, one of the following messages is displayed on the monitor under the Main Diagnostic Menu.

PREVIOUSLY RUN INDIVIDUAL TEST - PASSED

PREVIOUSLY RUN INDIVIDUAL TEST - FAILED

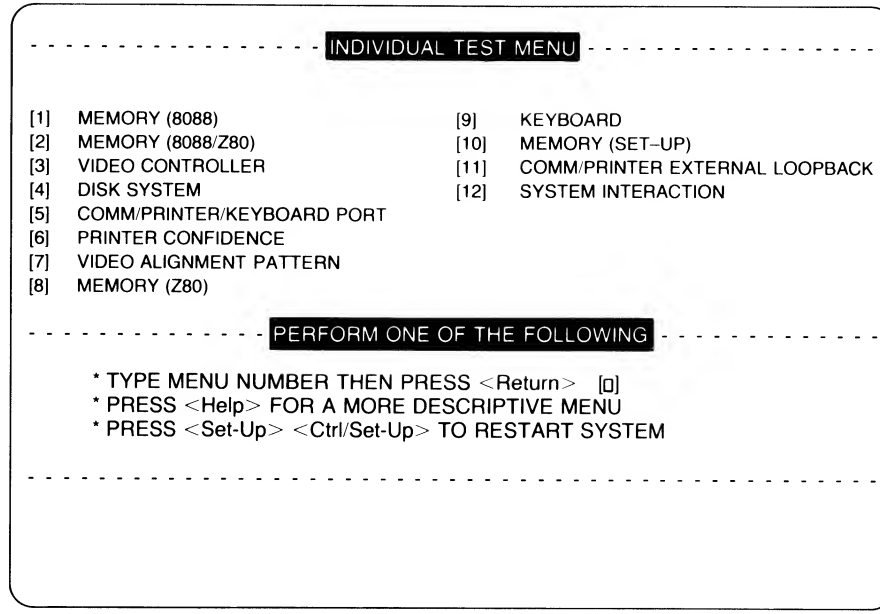


Figure 5-11. Individual Test Menu

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Video Controller Test

This test is a series of displays, each of which is shown on the monitor for 20 seconds.

To begin the displays, press the **Resume** key. To hold a display, press the **Interrupt** key. To continue to the next display, press the **Resume** key.

Printer Confidence Test

The printer confidence test allows you to send a message of any length to the printer and verify that the printer received your message. The test requests that you input a message. To start printing your message, press the **Escape** key (**ESC** on the keyboard label strip). The message is then sent to the printer continuously. To stop the test, press the **ESC** key or the **Return** key twice.

Video Alignment Pattern

The video alignment pattern test fills the printing area of your monitor with E's so that you can check its alignment of characters with the video alignment template (Digital part number, 29-24370). To exit the test, press the **Return** key.

Keyboard Test

The keyboard test displays a layout of the keyboard on the monitor. As you press each key, the displayed pattern of that key disappears (and reappears when pressed again) to confirm that the key is working correctly. Certain keys respond differently as follows. You type **OUT** to return to the Main Diagnostic Menu.

- Pressing the **Hold Screen** key lights the Hold Screen light.
- Pressing the **Set-Up** key causes the computer to enter Set-Up mode.
- Pressing the **Lock** key lights the Lock light on the keyboard and prevents the monitor from responding to the other keys.
- To check the **Ctrl** or **Shift** keys, hold key down and press any other key.

6
Troubleshooting

Introduction

This chapter gives troubleshooting information that will help you isolate and solve some problems in your Rainbow 100 computer. Use the following procedure if the computer does not respond correctly after you install it or if it reports an error message.

Troubleshooting Procedure

Refer to Table 6-1 to find a symptom of the problem. Listed with each symptom are one or more of its possible causes and the corrective actions you can take to fix them.

If an error message occurs during power-up, refer to Appendix B to determine a corrective action.

Table 6-1. Troubleshooting Procedure

Symptom	Probable Cause	Corrective Action
No response when the power switch is set to the on (1) position.	Brightness or contrast controls need adjustment.	Adjust brightness and contrast controls on the back panel of the monitor.
	The system unit is not plugged in; no power from the wall receptacle.	Plug the power cord into the back of the system unit and the wall receptacle. Use a different socket to check if there is no power.
	Circuit breaker	Push in the circuit breaker on the back of the system unit. If the circuit breaker comes out again, there is a possible short circuit in the system. Call Digital Field Service.
	Power cord	Check the power cord for possible damage. Replace the power cord if necessary.
The system powers up and sounds 2 bell tones. An error message appears on the monitor, along with the Main System Menu.	The system has a nonfatal error; one of its operational modes is not working.	Check the error message in Appendix B for its corrective action.
System powers up and sounds 3 bell tones. A message may or may not appear on the monitor.	The system uncovered an error during its power-up sequence, and the error must be found before continuing.	Reset the system and try again. If 3 bell tones sound again, check the monitor for an error message. If no message appears, check the lights at the back of the system unit. They may point to the location of the problem. (See Appendix B.) ***NOTE:*** *Refer to the* Rainbow™ 100 User's Guide *for errors that occur with the operating system.*
Wrong characters appear on the monitor while typing on the keyboard.	The following Set-Up features may be set incorrectly. • ANSI/VT52 • US/UK character set	Check these Set-Up features.

Table 6-1. Troubleshooting Procedure (Cont)

Symptom	Probable Cause	Corrective Action
Wrong characters are being received by the Rainbow 100 computer.	The following communications Set-Up features, which are to match incoming data, may be set incorrectly. • Modem receive baud rate • Data bits/parity • Modem protocol • Modem stop bits • ANSI/VT52 • Auto-wrap • New line mode • Received parity check	Check these Set-Up features.
The substitution character (▒) is displayed on the monitor instead of the character expected (or as typed on-line with a remote computer).	Parity Set-Up feature is set incorrectly. XON/XOFF is not supported by the remote computer or is not turned on. Transmit or receive baud rate is set incorrectly.	Check these Set-Up features.

Appendices

A

Rainbow 100 Computer Specifications

Rainbow 100 Computer System Specifications

Standard system:	System unit, keyboard, monitor, and operating system
System unit:	
Processors	Z80A and 8088 processors
Memory for programs	64K bytes (basic system) Expandable to 256K bytes
Printer connector	Serial, RS-423
Communications connector	Speeds up to 19,200 baud with modem control
Storage	Dual-disk drive (2 × 400K bytes)

Video output:	Monochromatic, RS-170 compatible
Environment:	Class A: Air-conditioned office or light assembly area
Temperature	
Operating*	15° C to 32° C (59° F to 90° F)
Not operating	− 34° C to 60° C (− 29° F to 140° F)
Relative humidity	
Operating	20% to 80% with maximum wet bulb 25° C (77° F) and minimum dew point 2° C (36° F)
Not operating	5% to 95% (noncondensing)
Altitude (maximum)	
Operating	2.4 km (8,000 ft)
Not operating	9.1 km (30,000 ft)
Magnetic field	The RX50 diskette may lose data when exposed to a magnetic field strength of 50 oersteds or more.
System expansion:	Three dedicated spaces for option modules that are user-installable

Hardware options:

Additional memory – 64K or 192K bytes

Second dual-disk drive (2 × 400K bytes)

Extended communications

Color graphics

*Maximum allowable temperature is reduced by 1.8° C per 1000 m (1° F per 1000 ft) above sea level. Example: At 2.4 km (8000 ft), the maximum temperature is 27.5° C (82° F).

Any Digital printer with the same FCC classification as the Rainbow 100 computer, such as the LA50 Personal Printer, LA100 Letterprinter 100, or LQP02 Letter-Quality Printer

Optional floor stand for vertical mounting of the system unit

Monitor Specifications

Characters: 7 × 9 dash matrix; includes 2 descenders

Format: 24 lines × 80 or 132 characters

Physical description:

Height	29.2 cm (11.5 in)
Width	34.9 cm (13.75 in)
Depth	31.1 cm (12.25 in)
Weight	6.4 kg (14 lb)
Cord	1.9 m (6 ft)

Adjustable tilt: +5 to −25 degrees

Video format: Monochromatic, composite

Keyboard Specifications

Audio and visual indicators: 4 lights and bell tone generator

Cord: 1.9 m (6 ft) coiled cord; 4-pin, telephone-type modular connectors; plugs into back of monitor

Physical description: Low-profile, detachable

Height	5 cm (2.0 in) at highest point
Length	53.3 cm (21 in)
Width	17.1 cm (6.75 in)
Weight	2 kg (4.5 lb)

Keypad:	Sculptured key array
Home row key height:	3 cm (1.2 in) above desktop
Keys:	105 keys; matte, textured-finished, concave surface
Size (each)	1.27 cm (0.50 in) square
Spacing	1.9 cm (0.75 in) center-to-center (single-width keys)
Wobble	Less than 0.5 mm (0.020 in)
Force to activate	53 g to 79 g (1.8 oz to 2.7 oz); space bar is double this amount
Travel to activate	Less than 0.3 cm (0.12 in)
Numeric keypad:	18 keys
Function keys:	36 keys; firmware- and software-driven; 20 function keys horizontally positioned below label strip
Power:	+12 V ± 5% @ 400 mA, 4.8 W maximum

System Unit and Power Supply Specifications

Physical description:

Height	16.5 cm (6.5 in)
Length	48.3 cm (19 in)
Width	36.3 cm (14.3 in)
Weight (maximum)	13.6 kg (30 lb)
Power supply type:	Transistor, switching-type AC-to-DC converter

AC input:	Switch-selectable
115 V (nominal)	Single-phase, 3-wire, 90 V to 128 V rms; 47 Hz to 63 Hz line frequency
230 V (nominal)	Single-phase, 3-wire, 174 V to 256 V rms; 47 Hz to 63 Hz line frequency
Line current:	3 A @ 115 Vac 1.5 A @ 230 Vac
AC power consumption:	218 W
Regulated voltages	+5.1 V ±5% +12.1 V ±5% −12 V ±7%
Circuit protection:	Circuit breaker, externally accessible

RX50 Dual-Disk Drive Specifications

Performance:

Diskettes per dual-disk drive	2
Number of recording surfaces per diskette	1
Storage capacity per diskette (80 tracks)	400K (409,600) bytes
per track (10 sectors)	5,120 bytes
per sector	512 bytes
Transfer rate	250,000 bits/s
Average access time	290 ms

Functional Specifications:

Rotational speed	300 r/min
Density	96 tracks per inch

Physical Specifications:

Height	8.4 cm (3.3 in)
Width	14.7 cm (5.8 in)
Depth	21.6 cm (8.5 in)
Weight	1.7 kg (3.8 lb)

B

Rainbow 100 Error Messages

Internal Diagnostic Test Error Messages

Table B-1 lists the Rainbow 100 error messages that may occur during power-up, reset, or selftest. It also shows the light display on the back of the system unit for each error message. (See Figure B-1 for an example.) The replacement procedures for the computer's components are found in the *Rainbow™ 100 User's Service Guide.*

To order parts contact your dealer or your local Digital service center.

Diskette Diagnostic Test Error Messages

Table B-2 lists the error messages that may occur while running the Rainbow 100 diskette diagnostic test and the possible sources of the problems they indicate. More than one possible source is given in some cases.

Table B-1. Internal Diagnostic Test Error Messages

Error Messages CONSULT USER'S GUIDE FOR ASSISTANCE – followed by:	Tested During: Power-Up	Reset	Self-Test	Light Display 1 2 3	4 5 6 7	Fatal	Corrective Action†
MAIN BOARD, rom crc, rom #0	Yes	No	Yes	● ● ●	● ● ● ●	Yes	Replace system module.
MAIN BOARD, rom crc, rom #1	Yes	No	Yes	● ● ●	● ● ● o	Yes	Replace system module.
MAIN BOARD, rom crc, rom #2	Yes	No	Yes	● ● ●	o ● ● ●	Yes	Replace system module.
MAIN BOARD, video ram	Yes	Yes	Yes	● ● ●	o ● ● o	Yes	Replace system module.
MAIN BOARD, video vfr	Yes	No	Yes	● ● ●	o ● o ●	Yes	Replace system module.
MAIN BOARD, video	Yes	No	Yes	o ● ●	o ● o ●	Yes	Replace system module.
MAIN BOARD, ram 0–64K	Yes	Yes	Yes	- - -	● ● o ●	Yes	Replace system module.
RAM OPTION	No	No	Cond.	o o o	o o o o	No	Check Set-up Display – Memory. Be sure to save the memory size. Reseat memory option. Try again. Replace memory extension option.
MAIN BOARD, ram arbitration	Yes	No	Yes	● ● ●	o ● o o	Yes	Replace system module.
MAIN BOARD, nvm data	Yes	No	Yes	o o o	o o o o	No	Enter Set-up and recall default settings by pressing <**Shift/D**>. Save these settings by pressing <**Shift/S**>. Turn power off then on; if this error still occurs, replace system module.

Table B-1. Internal Diagnostic Test Error Messages (Cont)

Error Messages CONSULT USER'S GUIDE FOR ASSISTANCE – followed by:	Tested During: Power-Up	Reset	Self-Test	Light Display 1 2 3	4 5 6 7	Fatal	Corrective Action†
MAIN BOARD, comm. port	Yes	No	Yes	o o o	o o o o	No, but terminal mode is not operational.	Replace system module.
MAIN BOARD, printer port	Yes	No	Yes	o o o	o o o o	No, but you cannot use the printer.	Replace system module.
MAIN BOARD, keyboard port	Yes	No	Yes	o o ●	● o ● o	Yes	Replace system module.
KEYBOARD	Yes	Yes	Yes	● ● o	● o ● o	Yes	Make sure keyboard cable is plugged in. Replace keyboard or its cable.
RX50 CONTROLLER BOARD	Yes	No	Yes	o o o	o o o o	No, but you cannot boot a diskette; use terminal mode only.	Make sure RX50 controller module is seated firmly on system module. Replace RX50 controller.

NOTES:

● = On, o = Off, - = On or Off;
Cond. = Conditional if connection is made.
Drive X = Drive A, B, C, or D.
*These errors can occur at any time because their circuits are tested constantly.
†Procedures to remove and replace the field-replaceable units are found in the *Rainbow™ 100 User's Service Guide.*

Table B-1. Internal Diagnostic Test Error Messages (Cont)

Error Messages CONSULT USER'S GUIDE FOR ASSISTANCE – followed by:	Tested During: Power-Up	Reset	Self-Test	Light Display 1 2 3	4 5 6 7	Fatal	Corrective Action†
DRIVE X, restore	Yes	No	Yes	o o o	o o o o	No	Replace disk drive unit assembly. Try again.
DRIVE X, step	Yes	No	Yes	o o o	o o o o	No	Replace disk drive unit assembly. Try again.
DRIVE X, index	No	No	Yes	o o o	o o o o	No	Check diskette, it may be upside down.
DRIVE X, motor	No	No	Yes	o o o	o o o o	No	Try a new diskette; if error still occurs, replace disk drive.
DRIVE X, seek	No	No	Yes	o o o	o o o o	No	Diskette may be unformatted; try a new diskette; if error still occurs, replace disk drive.
DRIVE X, read	No	No	Yes	o o o	o o o o	No	Diskette is bad or is for a different computer; try a new diskette.

Table B-1. Internal Diagnostic Test Error Messages (Cont)

Error Messages CONSULT USER'S GUIDE FOR ASSISTANCE – followed by:	Tested During: Power-Up	Reset	Self-Test	Light Display 1 2 3	4 5 6 7	Fatal	Corrective Action†
DRIVE X, not ready *or* drive not ready	No	No	Yes	o o o	o o o o	No	Make sure a diskette is installed in Drive X and its door is closed. Try another diskette.
MAIN BOARD, contention	Yes	No	Yes	o o o	o o ● o	Yes	Replace system module.
MAIN BOARD, Z80 crc	Yes	Yes	Yes	● ● ●	● o o ●	Yes	Replace system module.
MAIN BOARD, Z80 response*	Yes	No	Yes	● ● ●	● o o o	Yes	Make sure you are not using a VT180 system diskette. Replace system module.
MAIN BOARD, unsolicited interrupt*	Yes	Yes	Yes	● ● ●	● o ● o	Yes	Replace system module.
MAIN BOARD, unsolicited interrupt, Z80*	Yes	No	Yes	● ● ●	o o o ●	Yes	Replace system module.

NOTES:

● = On, o = Off, - = On or Off;
Cond. = Conditional if connection is made.
Drive X = Drive A, B, C, or D.
*These errors can occur at any time because their circuits are tested constantly.
†Procedures to remove and replace the field-replaceable units are found in the *Rainbow™ 100 User's Service Guide.*

Table B-1. Internal Diagnostic Test Error Messages (Cont)

Error Messages CONSULT USER'S GUIDE FOR ASSISTANCE – followed by:	Tested During: Power-Up	Reset	Self-Test	Light Display 1 2 3	4 5 6 7	Fatal	Corrective Action†
MAIN BOARD, interrupts off*	Yes	No	No	● ● ●	o o o o	Cond.	If this error occurs during power-up or selftest, replace system module; if this error occurs during an application program, the error can be a program "bug" (in either the operating system or the application program) that turns off the interrupts for an excessive time.
remove card or diskette	Yes	Yes	Yes	o ● ●	o o o ●	No	Remove card or check diskette.
Set-Up defaults stored	Yes	Yes	Yes	o o o	o o o o	No	Check Set-Up selections.
boot load	No	No	No	o o o	o o o o	No	RX50 diskette is blank and unformatted; try a new diskette.

NOTES:

● = On, o = Off, - = On or Off;
Cond. = Conditional if connection is made.
Drive X = Drive A, B, C, or D.
*These errors can occur at any time because their circuits are tested constantly.
†Procedures to remove and replace the field-replaceable units are found in the *Rainbow™ 100 User's Service Guide.*

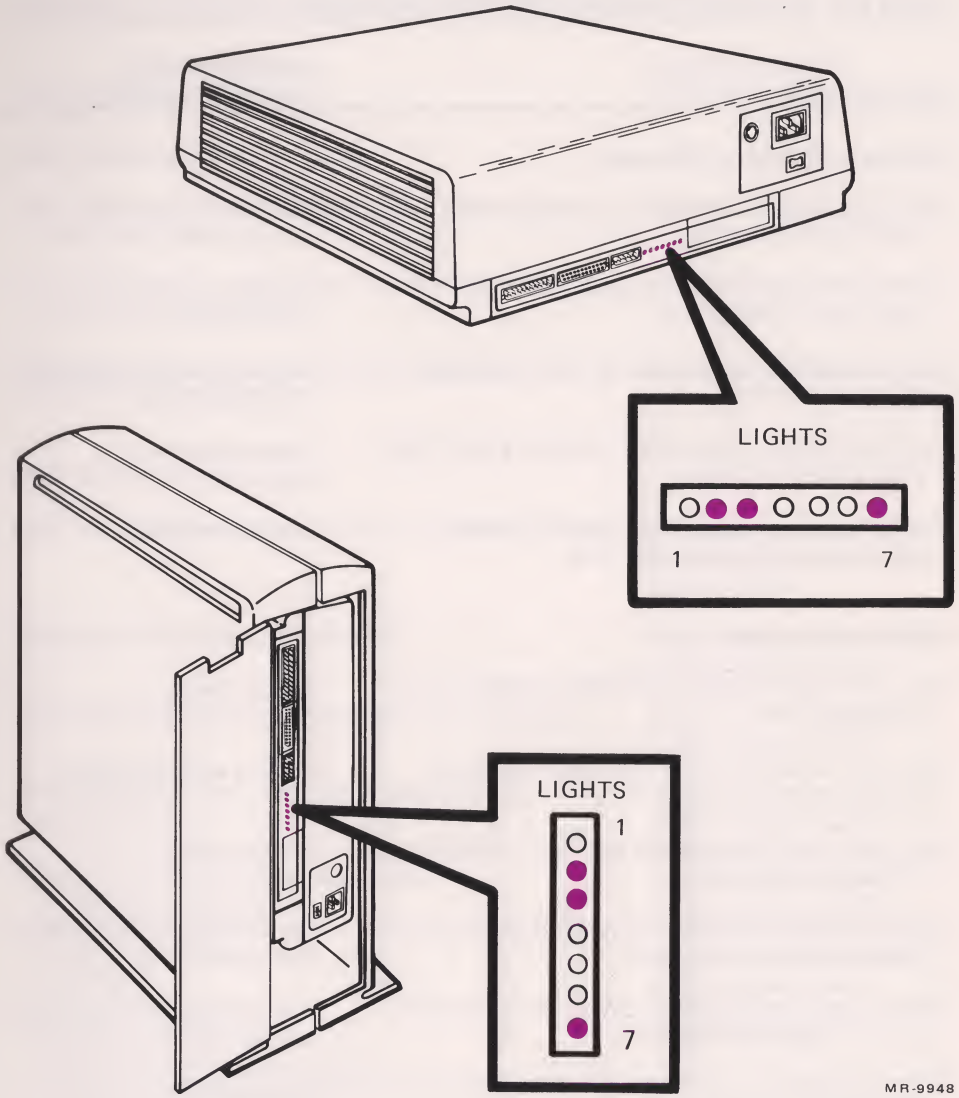


Figure B-1. Example of a Light Display on the Back of the System Unit

Table B-2. Diskette Diagnostic Test Error Messages

Error Messages	Possible Source/ Corrective Action
Diagnostic Executive Messages	
SYSTEM ERROR: COMPUTER CANNOT FIND SUFFICIENT MEMORY	Diagnostic diskette or system module.
SYSTEM ERROR: TEST PROGRAM DOES NOT FUNCTION CORRECTLY	Diagnostic diskette or system module.
SYSTEM ERROR: DISK READ OR WRITE FAILED RESTART SYSTEM	Diagnostic diskette, disk drive, or system module.
SYSTEM ERROR: COMPUTER CANNOT READ TEST FILE FROM THE DISK	Diagnostic diskette.
SYSTEM ERROR: COMPUTER CANNOT READ MESSAGE FILE FROM THE DISK	Diagnostic diskette.
RAM Test Messages	
FAILURE: MAIN BOARD: MEMORY STORES DATA INCORRECTLY	System module.
FAILURE: MEMORY OPTION BOARD: MEMORY STORES DATA INCORRECTLY	Memory extension option.
FAILURE: MAIN BOARD: INVALID SET-UP DATA FOR OPTIONAL MEMORY	System module.
ERROR: OPTION MEMORY BOARD PRESENT; SET-UP SHOWS IT IS NOT PRESENT	Set-Up display for memory size is incorrect.
ERROR: OPTION MEMORY BOARD NOT PRESENT; SET-UP SHOWS IT PRESENT	Set-Up display for memory size is incorrect.
SYSTEM ERROR: COMPUTER CANNOT FIND SUFFICIENT MEMORY	System module.
SYSTEM ERROR: SYSTEM CLOCK DOES NOT WORK	System module.
ERROR: SET-UP FOR MEMORY SIZE IS NOT CORRECT	Set-Up display for memory size is incorrect.
TEST CANNOT CONTINUE – PLEASE RESTART SYSTEM	Diagnostic diskette.

Table B-2. Diskette Diagnostic Test Error Messages (Cont)

Error Messages	Possible Source/ Corrective Action
RAM Arbitration Test Messages	
FAILURE: MAIN BOARD: MEMORY STORES DATA INCORRECTLY	System module.
SYSTEM ERROR: COMPUTER CANNOT FIND SUFFICIENT MEMORY	System module.
SYSTEM ERROR: TEST PROGRAM DOES NOT FUNCTION CORRECTLY	Diagnostic diskette.
Disk Drive Error Messages	
FAILURE: MAIN BOARD: ILLEGAL INTERRUPT TO Z80	Not a test, just a catch; repeat test; if error persists, replace system module.
Z80 DIAGNOSTIC FILE NOT FOUND	Cannot find file on diskette; try another diagnostic diskette.
FAILURE: MAIN BOARD: Z80 RESPONSE FAILURE	Repeat test; if error persists, replace system module.
SYSTEM ERROR: INSUFFICIENT MEMORY FOR DIAGNOSTICS	Repeat test; if error persists, replace system module.
FAILURE: RX50 CONTROLLER BOARD: INTERNAL REGISTER HEAD LOAD TIMING LOOP BACK READ RESTORE MOTOR SHUT OFF FORCED SEEK SEEK FAILURE (with no verify) FORCED RECORD NOT FOUND (read) FORCED LOST DATA (read) NO TRACK GREATER THAN 43 SIGNAL FORCED RECORD NOT FOUND (write) FORCED LOST DATA (write) WRITE SECTOR	Bad connection between system module and RX50 controller module; remove and reseat controller module. Run test again; if error persists, replace RX50 controller module.

Table B-2. Diskette Diagnostic Test Error Messages (Cont)

Error Messages	Possible Source/ Corrective Action
FAILURE: RX50 CONTROLLER BOARD: WRITE SECTOR	Could be a bad diskette; try another diskette and run test again. If error persists, remove and reseat RX50 controller module; if error still persists, replace RX50 controller module.
FAILURE: DRIVE X (where X = A, B, C, or D) – DRIVE NOT READY	Diskette is not inserted or is upside down; disk drive door is open.
INDEX PULSE	Diskette may be upside down or is not spinning.
SEEK (with verify)	Could be a bad diskette; rerun test using another diskette.
READ SECTOR	May occur after a write sector failure. Could be a bad diskette; try another diskette.
WRITE SECTOR	Could be a bad diskette; try another diskette.
DISK WRITE PROTECTED	Write-protect tab is on diskette.

NOTE: *The following disk drive error messages may occur from poor connection between the RX50 controller module and the disk drive. Reseat cables and rerun tests. If any of these errors persist, remove and replace the disk drive.*

FAILURE: DRIVE X (where X = A, B, C, or D) – RESTORE	No track 0 signal coming from drive; try again; replace disk drive.
STEP	Head did not move in correct amount of time; try again; replace disk drive.

Table B-2. Diskette Diagnostic Test Error Messages (Cont)

Error Messages	Possible Source/ Corrective Action
MOTOR SPEED	Disk drive motor is turning too fast or too slow; diskette may be warped, try another; replace disk drive.
STEP-IN	Head did not move toward spindle correctly; replace disk drive.
STEP-OUT	Head did not move away from spindle correctly; replace disk drive.
MULTI-TRACK TIMING	Head did not move away from spindle correctly; replace disk drive.
Z80 Private RAM Test Error Messages	
ERROR: TEST PROGRAM CANNOT BE LOADED FROM DISKETTE	Diagnostic diskette.
SYSTEM ERROR: TEST DOES NOT FUNCTION CORRECTLY	Diagnostic diskette or system module.
FAILURE: MAIN BOARD: Z80 FAILED TO START MEMORY TEST	System module.
FAILURE: MAIN BOARD: Z80 FAILED TO COMPLETE MEMORY TEST	System module.
FAILURE: MAIN BOARD: Z80 PRIVATE MEMORY DOES NOT STORE DATA CORRECTLY	System module.
FAILURE: MAIN BOARD: Z80 CANNOT COPY DATA TO SHARED (Z80/8088) MEMORY	System module.
FAILURE: MAIN BOARD: Z80 CANNOT RESTORE DATA TO Z80 PRIVATE MEMORY TEST CANNOT CONTINUE, PLEASE RESTART SYSTEM –	Reboot system and try again; if error persists, replace system module.
FAILURE: MAIN BOARD: Z80 DID NOT EXECUTE THE TEST CORRECTLY	Diagnostic diskette or system module.

C

Rainbow 100 Parts List and Reference Manuals

Rainbow 100 Parts List

Table C-1 lists the user-replaceable parts of the Rainbow 100 computer and their part numbers. For a more detailed parts list and description, refer to the *Rainbow™ 100 Illustrated Parts Breakdown.*

Reference Manuals

Table C-2 lists reference manuals that may be helpful to you.

Ordering Information

Digital's customers may purchase parts or manuals by forwarding a purchase order to:

Digital Equipment Corporation
Accessories and Supplies Group
P.O. Box CS2008
Nashua, New Hampshire 03061

Table C-1. Rainbow 100 Parts List

Part	Digital Part Number
System module	70-19974
RX50 controller module	54-15482
64K byte memory extension option	PC1XX-AA
192K byte memory extension option	PC1XX-AB
Power supply	H7842-A
RX50 dual-disk drive	RX50-AA
RX50 diskettes (pack of 10)	30-19448-02
Keyboard, U.S.	LK201-AA
Keyboard label strip	36-20220-12
Video monitor assembly (white phosphor)	VR201-AA
Cable, power supply to system module, 7.6 cm (3 in)	17-00318-01
Cable, RX50 shielded, 20.3 cm (8 in)	17-00317-03
Cable, RX50 shielded, 36.8 cm (14.5 in)	17-00317-04
Line cord, 115 Vac	17-00083-09
Cable, keyboard	BCC01
Cable, monitor 1.8 m (6 ft)	17-00283-00
Cable, communications/printer, 3 m (10 ft)	BCC04-10
Cable, communications/printer, 7.6 m (25 ft)	BCC04-25
Cable, communications/printer, 15.3 m (50 ft)	BCC04-50
Standoff	12-19857-01
COMM connector loopback plug	12-15336-01
PRINTER connector loopback plug	12-15336-03

Table C-2. Reference Manuals

Title	Digital Part Number
Rainbow™ 100 Installation Guide	EK-P100E-IN
Rainbow™ 100 User's Service Guide	EK-P100E-SV
Rainbow™ 100 Illustrated Parts Breakdown	EK-PC100-IP
Rainbow™ 100 Pocket Service Guide	EK-PC100-PS
Rainbow™ 100 Memory Extension Option Installation Guide	EK-PCMXE-IN
Rainbow™ 100 Getting Started	AA-N575B-TV
Rainbow™ 100 User's Guide	AA-P300B-TV

Contact your local Digital sales office or call Digital's Direct Catalog Sales toll-free (800) 258-1710 from 8:30 a.m. to 5:00 p.m. eastern standard time (U.S. customers only). In New Hampshire, Alaska, and Hawaii call (603) 884-6660.

Terms and conditions include net 30 days and FOB from the Digital shipping point. Freight charges are prepaid by Digital and added to the invoice. (Orders placed against an open line of credit require the customer to pay the shipment charge.)

Shipment charges for all cash orders (that is, payment by check, MasterCard™, Visa®, or American Express®) are paid by Digital for shipment within the continental United States.

The payment of state and local taxes, duties, and levies is the responsibility of the buyer.

The minimum order is $35.00, but this minimum does not apply when full payment is sent with the order. Make checks and money orders payable to *Digital Equipment Corporation.*

D

International Language Keyboards

The figures in this appendix illustrate the different national language keyboards that are available. One of the main differences is the label strip that you add to the top of the keyboard. The label strip and instructions to install other language ROMs come with the documentation shipped with the system.

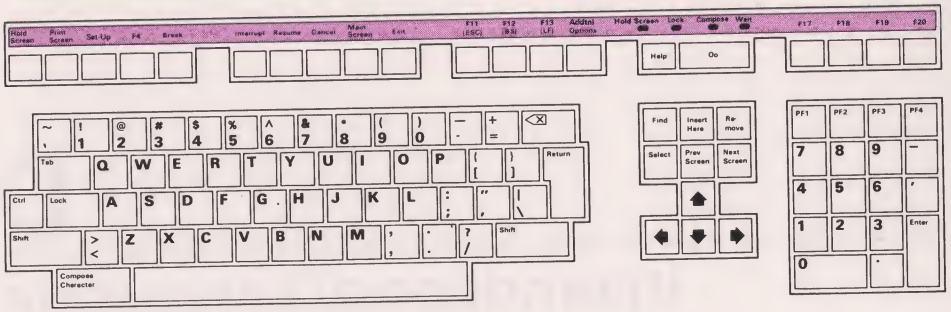


Figure D-1. LK201-AA American (English) Keyboard

MR-9959

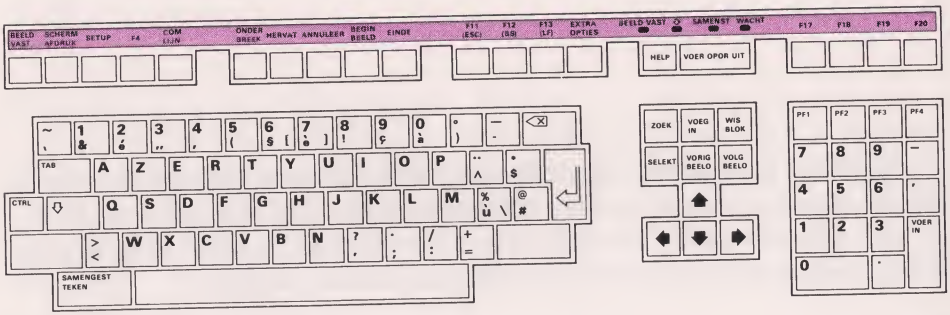


Figure D-2. LK201-AB Belgian/Flemish Keyboard

MR-9960

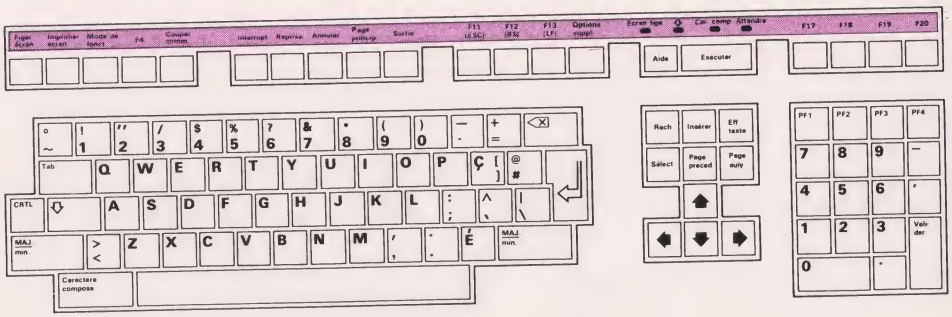


Figure D-3. LK201-AC Canadian (French) Keyboard

MR-9961

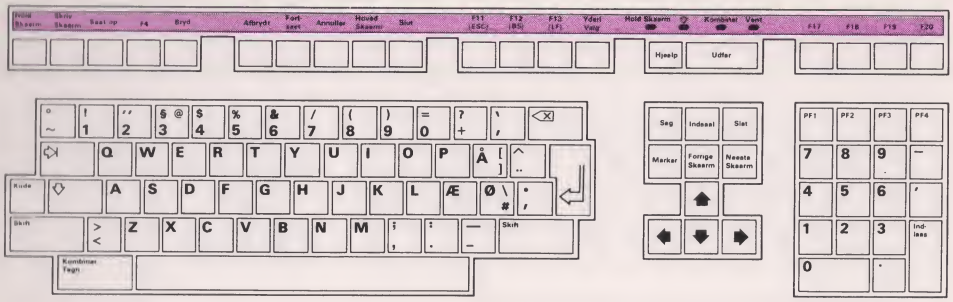


Figure D-4. LK201-AD Danish Keyboard

MR-9962

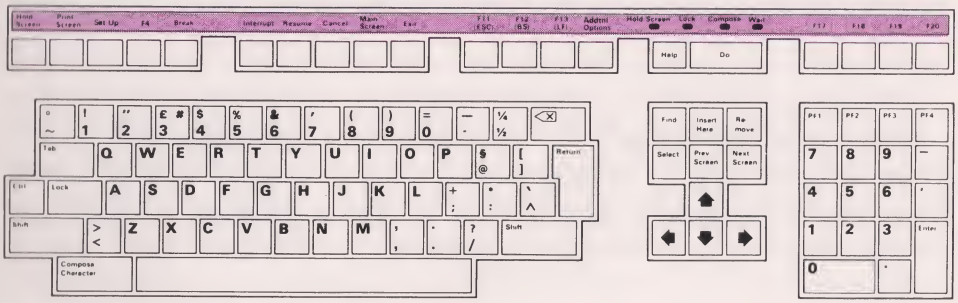


Figure D-5. LK201-AE British Keyboard

MR-9963

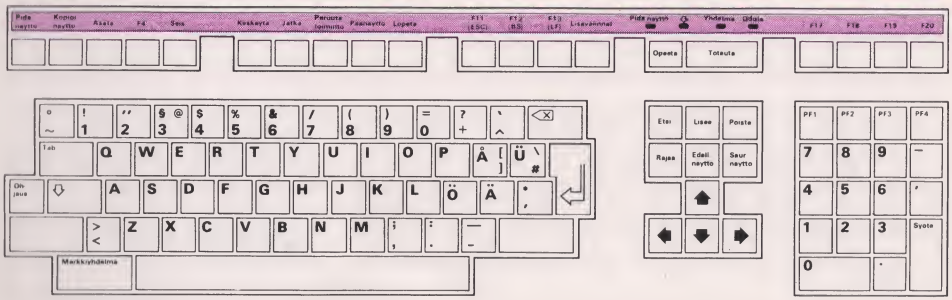


Figure D-6. LK201-AF Finnish Keyboard

MR-9964

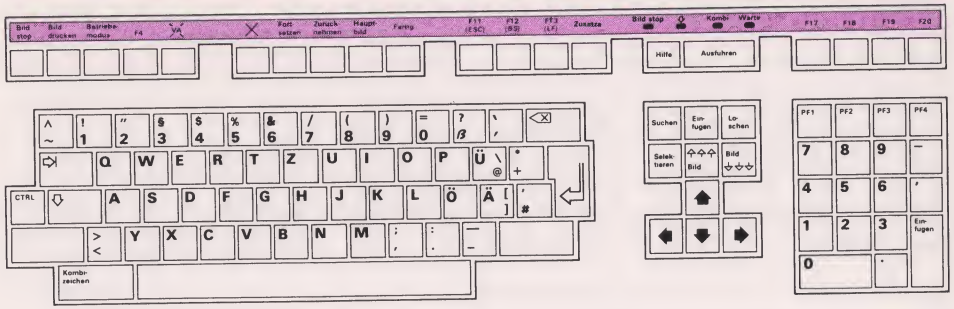


Figure D-7. LK201-AG Austrian/German Keyboard

MR-9965

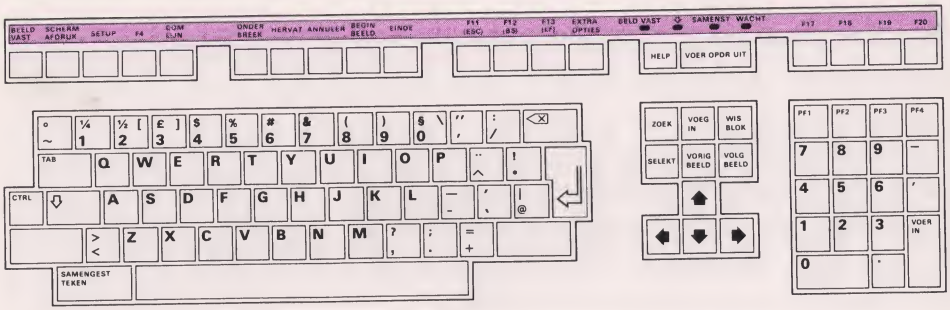


Figure D-8. LK201-AH Dutch Keyboard

MR-9966

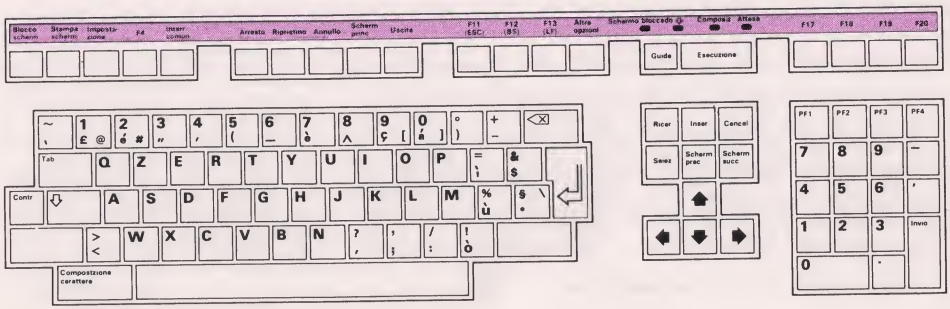


Figure D-9. LK201-AI Italian Keyboard

MR-9967

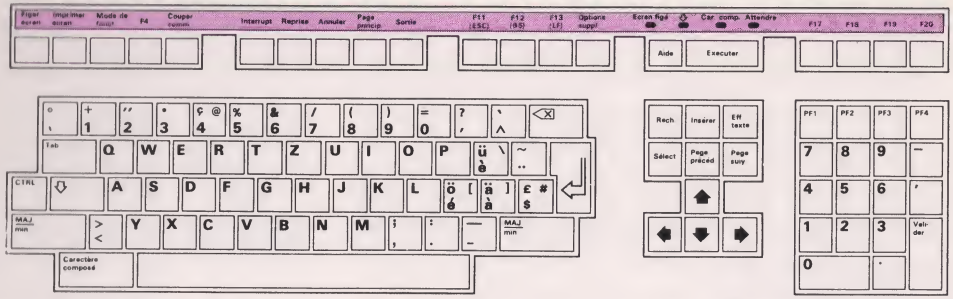


Figure D-10. LK201-AK Swiss (French) Keyboard

MR-9968

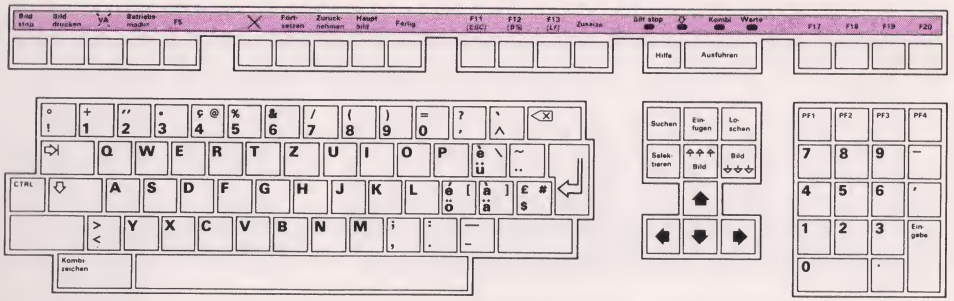


Figure D-11. LK201-AL Swiss (German) Keyboard

MR-9969

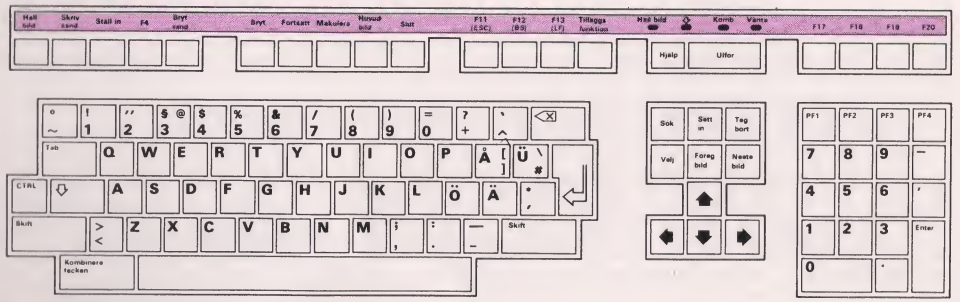


Figure D-12. LK201-AM Swedish Keyboard

MR-9970

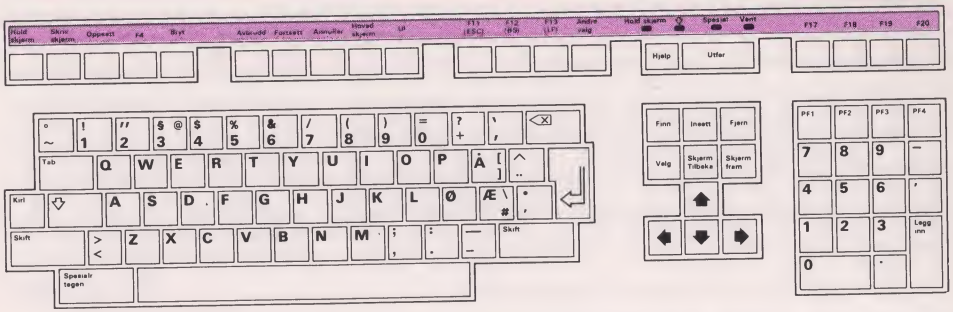


Figure D-13. LK201-AN Norwegian Keyboard

MR-9971

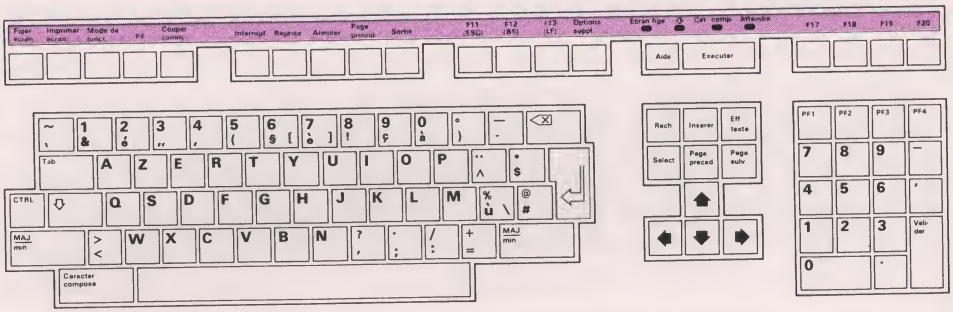


Figure D-14. LK201-AP Belgian/French Keyboard

MR-9972

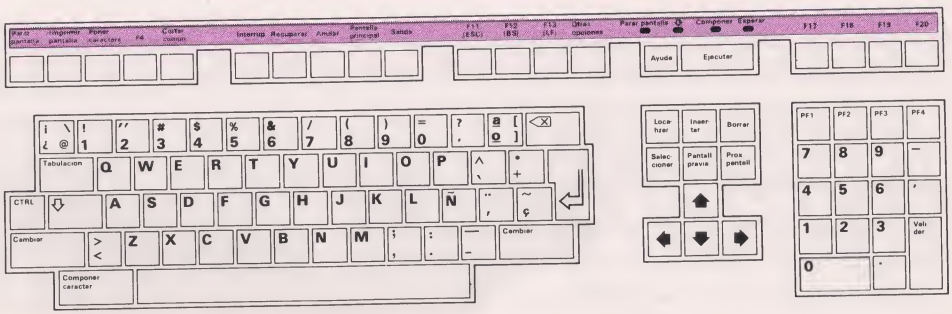


Figure D-15. LK201-AS Spanish Keyboard

MR-9973

Glossary

ANSI

American National Standards Institute, 1430 Broadway, New York, N.Y. 10018. The Rainbow 100 computer responds to certain control functions standardized by ANSI.

Answerback message

A short message of up to 20 characters that the Rainbow 100 computer transmits upon receipt of an enquiry (ENQ) control character; generated by a <**Ctrl**/**Break**> and sent to a remote computer or (optionally) upon first starting communications in terminal mode.

Arbitration

A circuit in the Rainbow 100 computer that decides which event has priority.

ASCII

American Standard Code for Information Interchange, in which each character is represented by a 7- or 8-bit code; included are numbers, letters, punctuation, and special control characters.

Asymmetrical

Pertaining to a communications protocol in the Rainbow 100 computer that uses the secondary channel of a half-duplex modem to provide full-duplex operation. (The modem requires a special cable.)

Asynchronous

Pertaining to a communications method in which the data has its own synchronizing information in start and stop signals.

Attribute

A characteristic assigned to a character or a word, such as boldface, underlined, or blinking.

Auto-Answerback

A feature in the Rainbow 100 computer that allows it to send its answerback message to a remote computer when communication is established between them.

Auto-Screen Blank

A feature in the Rainbow 100 computer that turns off the display on the monitor after 30 minutes, leaving only a "phantom" blinking cursor.

Auto-Wrap

A feature in the Rainbow 100 computer that prevents characters from printing over the last character on a line; instead, they continue printing on the next line.

Auto-XON/XOFF

A feature in the Rainbow 100 computer that automatically synchronizes it to a remote computer so as not to lose data.

Baud rate

The speed at which data bits are transmitted; for example, bits per second.

Bell System type modem

A communications data set that translates computer signals to standard telephone transmission signals, and vice versa.

Binary

Two-valued arithmetic or logic, using values 1 and 0. All computer programs use the binary form.

Bit

A binary digit; the smallest unit of information in a binary form, represented as either a 1 or a 0.

Block diagram

A simplified drawing that uses boxes and interconnecting lines to represent the components of a system and their relationships.

Boot (Bootstrap)

1) A small program executed when the computer is turned on whose purpose is to load and start a larger program or the operating system. 2) To start such a program.

Break

1) To open. 2) A signal to stop transmission. 3) A space (0) on the transmit data line if transmission is enabled. 4) The key used to generate such a signal.

Buffer

A storage area meant to temporarily hold data being transferred between two devices.

Bug

An instruction or sequence of instructions in a program that causes unexpected results.

Bus

A conductor through which signals are transmitted between a source and a destination.

Byte

One character position; eight bits of binary data.

CCITT

Comite Consultatif International Telegraphique et Telephoniques (International Telegraph and Telephone Consultative Committee), which sets international communications standards.

Channel

A path for electrical transmission between two points.

Character

A single letter, number, or symbol of information.

Character set

One of several groups of characters that can be generated by a keyboard.

Command

An instruction to a computer program, entered by typing on the keyboard.

Contention

A conflict between the two processors in the Rainbow 100 computer over a signal's availability.

Control function

An action that affects the processing, transmission, or interpretation of data.

Control (Ctrl)

The key used to start a control function.

Controller

An electronic unit that acts as a link between the processor and a peripheral device.

CRC

1) Cyclic redundancy check for errors. 2) The circuit that performs this check.

Cursor

The blinking marker on the monitor that indicates where the next character typed will be placed.

Data

A general term for information (numbers, letters, and symbols), stored, for example, on a diskette.

Default

The value of a selection assumed by the computer when a specific value is not supplied by the user.

Delimiter

A character that terminates a character string or message, or separates it from surrounding text.

Diagnostic program

A program that detects and isolates malfunctions.

Disk

A platter on which data is recorded magnetically. It features random access and faster access time than magnetic tape.

Disk drive

A peripheral device that reads and writes on a disk or diskette.

Diskette

A flexible, removable, magnetic disk; also known as a "floppy disk."

Duplex

In communications, pertaining to simultaneous, 2-way, independent transmission in both directions; also called "full-duplex."

EIA

1) Electronic Industry Association, 2001 Eye Street N.W., Washington, D.C. 20006. 2) A communications standard set by the EIA. 3) A signal that conforms to EIA standards.

8088 processor

A single-chip, 16-bit, parallel, central processing unit manufactured by Intel Corporation.

Emulation

A Rainbow 100 feature that enables control functions similar to those of the VT52 DECscope or those that agree with current ANSI standards.

EOT

End-of-transmission control character, created by typing <**Ctrl/D**>.

Escape (ESC)

The code that provides supplementary characters or commands to the computer when sent before such characters or commands.

FCC

Federal Communications Commission, Washington, D.C.

FDXA

A full-duplex communications protocol that does not use modem control signals.

FDXB

A full-duplex communications protocol that uses modem control signals.

FDXC

A full-duplex communications protocol that uses modem control signals on a half-duplex modem; requires a special cable.

Firmware

A program of instructions that is in read-only memory (ROM) so it will not be changed. The Rainbow 100 computer's firmware includes a selftest program that runs when you turn the computer on and displays the Main System Menu.

Floppy disk

A diskette.

Formatted diskette

A diskette that has its data track pattern already recorded on its surface. The Rainbow 100 computer uses diskettes that are formatted at the factory.

Form feed

A nonprinting character that causes a printer to advance its paper to the beginning of the next page.

Full-duplex

A communications method that allows transmit and receive data at the same time.

Hardware

Physical computer equipment; mechanical, electrical, or electronic devices.

Hertz (Hz)

A unit of frequency equal to one cycle per second.

Index

1) To move the cursor down to the same character position on the next line. 2) The small hole in the diskette that marks the beginning of the recorded tracks.

Interrupt

1) To break the normal operation of a program being executed. 2) The signal that causes such a break.

Key

A single button on the keyboard that, when pressed, sends a letter, number, symbol, or function code to the keyboard's electronic circuitry.

Keyboard

The typing device that causes characters and commands to be generated when its keys are pressed.

Keyclick

An audible sound made by the tone generator inside the keyboard when a key is pressed. In the Rainbow 100 computer the keyclick volume is adjustable in Set-Up.

Lead screw

The screw that guides the read/write heads of the RX50 dual-disk drive to the correct track on a diskette.

Load

To insert a diskette into the disk drive and close its door.

Main memory

The main storage area in a computer from which instructions are taken and executed.

Mark state

The presence of a signal, or logical 1 condition, on the communications line.

Mass storage medium

A product, such as a diskette, on which large amounts of data can be stored for ready access by a processor.

Menu

A list of services or functions displayed on the monitor from which you select one for the computer to do.

Mode

A state, such as line or local mode, or method of operation, such as terminal mode.

Modem

A telephone modulator-demodulator; a device that modulates signals for transmission over communications lines and demodulates them for reception.

Modulation

The process of changing some feature (amplitude, frequency, or phase) of a carrier signal to transmit the computer's data signals.

Monitor

1) The device that contains the video screen. 2) The video screen itself.

Monochromatic

Having only one color.

New line mode

A feature in the Rainbow 100 computer that, when in effect, causes the cursor to move to the beginning of the next line when the **Return** key is pressed.

Nonvolatile memory (NVM)

A memory whose contents are not destroyed when power is turned off.

Parameter

1) A variable that you give a specific value in order to set a feature of the Rainbow 100 computer. 2) A selection in Set-Up.

Parity

1) A method of checking for correct data that involves counting the 1 bits in each character's data pattern, and then making the sum either even or odd. 2) The choice in Set-Up for the method of checking parity, whether even, odd, Mark, Space, or no parity.

Peripheral device

An active device of a computer system, such as a disk drive or a printer, that extends the system's capacity or functionality.

Port

A connector on the back of the system unit that allows you to connect a peripheral device to the computer.

Processor

The functional part of the computer that uses instructions to perform computation or manipulation of data. The 8088 and the Z80A processor chips in the Rainbow 100 computer are examples.

Protocol

The format the computer uses to transmit and receive communications signals.

RAM

Random-access memory; a computer's main memory to which data is written and from which data is read. This memory can be expanded in the Rainbow 100 computer by adding the memory extension option.

RS-232-C

EIA standard for communications equipment. Off or Mark signals can be −3 V to 25 V; On or Space signals can be +3 V to +25 V.

RS-423

EIA standard for digital interface circuits. Signals for a binary 1 state can be −4 V to −6 V; signals for a binary 0 state can be +4 V to +6 V.

ROM

1) Read-only memory; the memory in the Rainbow 100 computer that contains the instructions for the power-up and reset sequences, the selftest, and the program that interprets the keyboard's keys. 2) Firmware.

Scratch diskette

A diskette used for temporary storage of data. It may contain data you do not care to save, or be a blank, formatted diskette.

Screen width

1) The maximum number of characters that can be displayed across the monitor on one line. 2) The setting in Set-Up that allows you to select 80 or 132 columns on the monitor.

Secondary channel

The communications line for control signals on a half-duplex modem.

Sector

One-tenth of a track on a diskette; it holds 512 data characters.

Serial transmission

A method of transferring data in which the bits of the characters are sent sequentially on a single path.

Set-Up

The state of the Rainbow 100 computer that allows you to change the settings of its variable features.

Space

The absence of a signal on the communications line; a logical 0 condition.

Specifications

The physical dimensions and functional features of a product.

Stepper motor

A motor that moves and stops in precise increments rather than spins freely.

Stop bit(s)

One or two pulses at the end of a character's data pattern that signal(s) the end of that pattern.

Synchronization

1) Operation in exact coincidence in time or rate. 2) Timing.

Synchronous

1) Having identical time periods. 2) Pertaining to a communications format in which each data character uses the same time period. The data, including blank time, is controlled by an external clock device or modem.

System

A combination of hardware and software that performs specific processing operations.

System module

The main circuit board where the processors and main memory reside.

System unit

The enclosure that holds the system module and the disk drives.

Terminal mode

1) An operational mode in the Rainbow 100 computer that allows it to act like a terminal, such as a VT102 video terminal. 2) Selection T on the Main System Menu.

Track

A path on a diskette that holds data. There are 80 tracks on each diskette.

Troubleshooting

Isolating a problem to a specific cause.

VT52

1) The VT52 DECscope; a video terminal manufactured by Digital Equipment Corporation. 2) A Set-Up feature in the Rainbow 100 computer that allows the computer to use control functions similar to those of the VT52 DECscope.

XON/XOFF

1) The control characters that synchronize the Rainbow 100 computer to a remote computer so that data transmitted between them is not lost. XON starts data transmission, XOFF stops it. 2) The Set-Up feature that enables these characters automatically. (See Auto-XON/XOFF.)

Z80A processor

A single-chip, 8-bit, parallel central processing unit manufactured by Zilog, Inc.

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